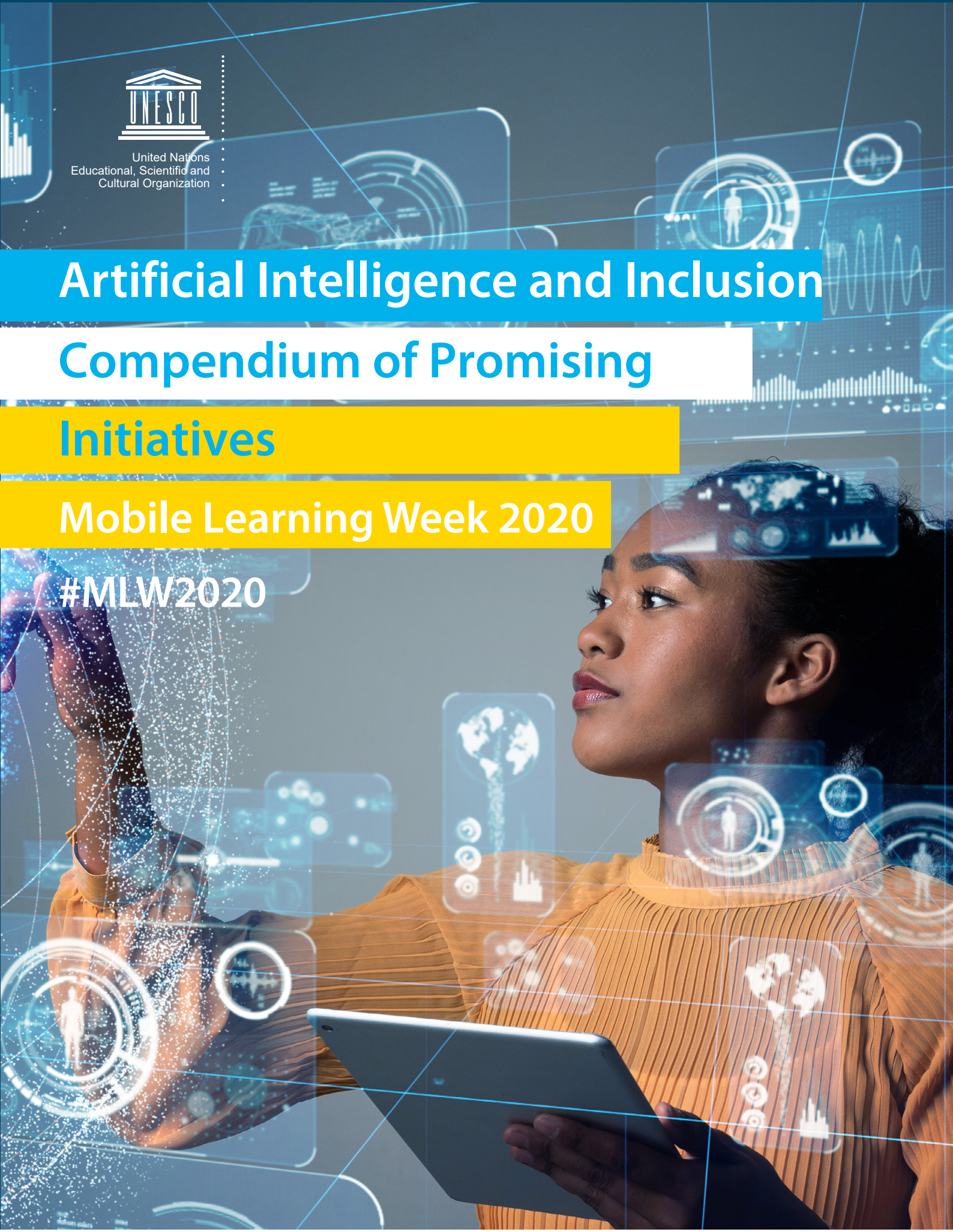
United Nations
Educational, Scientific and
Cultural Organization

Artificial Intelligence and Inclusion

Compendium of Promising Initiatives

Mobile Learning Week 2020

#MLW2020



Education 2030

mobile learning week 2020

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United Nations
Educational, Scientific and
Cultural Organization

Education Sector

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UNESCO, as the United Nations' specialized agency for education, is entrusted to lead and coordinate the Education 2030 Agenda, which is part of a global movement to eradicate poverty through 17 Sustainable Development Goals by 2030. Education, essential to achieve all of these goals, has its own dedicated Goal 4, which aims to ***"ensure inclusive and equitable quality education and promote lifelong learning opportunities for all."*** The Education 2030 Framework for Action provides guidance for the implementation of this ambitious goal and commitments.

Education 2030

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Due to the outbreak of the COVID-19 pandemic, UNESCO decided to suspend all large international events. As a consequence, the MLW 2020 on Artifcial I ntelligence and Inclusion, planned from 2 to 6 March at the UNESCO House, was postponed.

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Introduction

Origin and purpose of this compendium

This compendium has been compiled as a resource document for Mobile Learning Week 2020 (MLW2020), planned[1] under the theme "Artifcial Intelligence and Inclusion", with the intention of steering the use of artifcial intelligence (AI) towards inclusion and equity in and through education – core values underpinning the Sustainable Development Goals (SDGs) and digital opportunities for all. This theme was chosen to expand upon the implementation of the Beijing Consensus on AI and Education and the Cali Commitment to Equity and Inclusion in Education by exploring the best possible ways to leverage and steer the use of the most advanced technologies available in order to deal with the long-lasting challenges of inclusion and equity in education.

The MLW2020 Compendium of Promising Initiatives of ers a platform to demonstrate promising applications and practices that leverage AI to advance inclusion and equity in education submitted to the conference. These initiatives highlight the potential of AI in and for education to accelerate progress and bridge digital, gender, wealth, ability and other divides to create inclusive knowledge societies.

This compendium is a non-exhaustive attempt to present initiatives which planned presentations at MLW2020 in an organized and accessible manner for a wide audience, including education policy-makers; AI developers and practitioners; civil service, public beneft and mutual and cooperative organizations working in education (the third sector); and educationalists in administration as well as teachers and teacher trainers.

The conference called for conversations around four themes: (1) solidifying international cooperation to promote inclusive access to AI and digital innovations; (2) leveraging AI to advance inclusion in access to quality learning opportunities; (3) fostering AI innovations to enhance learning outcomes across learning settings; and (4) ensuring non-discriminatory and gender-equitable use of AI for lifelong learning.

The compendium follows the above four subthemes and the overarching questions of how education systems can integrate AI to support the learning and well-being of diverse populations and *how this integration can lead to better social outcomes, inclusive and equitable quality education and the promotion of lifelong learning opportunities for all can be addressed.*

Analysis of proposals received for the presentation of initiatives

While AI interventions are often complex and address multiple aspects of inclusion, initiatives were categorized according to their major theme, which was identifed as they emerged through analysis for this compendium. Each of the four sections of this compendium addresses initiatives which prominently respond to one of these subthemes.

Section 1: Solidifying international cooperation to promote inclusive access to AI and digital innovations

In the era of technology, international cooperation has become even more crucial. This section is inspired on the High-level Panel on Digital Cooperatio n[2] convened by the UN Secretary-General to advance global multi-stakeholder dialogue on how we can work better together to realize the potential of digital technologies for advancing human well-being while mitigating the risks.

Ef orts towards international cooperation in the space of AI can support more robust and comprehensive

1 The conference was to be held in Paris from 2-6 March 2020. However, due to the threats presented to the conference and its attendees as a result of the rapid global spread of Covid-19, the conference was postponed.
2 High-level Panel on Digital Cooperation convened by the UN Secretary-General: https://digitalcooperation.org/

development of open resources and tools which can then be leveraged across contexts. The knowledge base can be more ef ectively and efcien tly expanded and utilized through knowledge-sharing ef orts, and new initiatives can be built upon existing networks and partnerships to add value to products and services already in circulation. This section explores initiatives which are working towards international cooperation to improve the quality, inclusiveness and relevance of AI development and products across education contexts.

Ef orts towards international cooperation in the space of AI can support more robust and comprehensive development of open resources and tools which can then be leveraged across contexts. The knowledge base can be more ef ectively and efcien tly expanded and utilized through knowledge-sharing ef orts, and new initiatives can be built upon existing networks and partnerships to add value to products and services already in circulation. This section explores initiatives which are working towards international cooperation to improve the quality, inclusiveness and relevance of AI development and products across education contexts.

Focus areas included under this theme are:

- International cooperation for open resources using AI
- Sharing knowledge to improve the quality of AI for education
- Promoting online identities and digital participation
- Enhancing existing initiatives through networks and partnerships

Section 2: Leveraging AI to advance inclusion in access to quality learning opportunities

The Cali Commitment to Equity and Inclusion in Education defnes inclusion as "a transformative process that ensures full participation and access to quality learning opportunities for all children, young people and adults, respecting and valuing diversity, and eliminating all forms of discrimination in and through education" (UNESCO, 2019b: 1). The document further reafr ms the international commitment to equity and inclusion of persons with disabilities in formal education and lifelong learning pathways.

Ensuring inclusion in access to quality learning opportunities is at the heart of SGD 4, which sets the goal of inclusive and equitable quality education and lifelong learning opportunities for all. To achieve this goal, geographic, demographic, ability, age and access barriers must be overcome. AI can be leveraged to provide and support non-discriminatory access to quality learning opportunities. This section will examine the ways in which AI and open AI resources and tools are developed and deployed to support learners with disabilities and/or non-normative development patterns, students with developmental delays and minority groups.

Focus areas included under this theme are:

- Using AI and digital innovations to support learners with disabilities
- The use of AI tools to reduce language barriers and promote literacy education
- Leveraging AI tools and open resources to promote inclusive learning

Section 3: Fostering AI innovations to enhance learning outcomes across learning settings

Innovation is key to building system-wide strategies to tackle the current learning crisis. AI and other digital innovations have demonstrated a positive impact on learning outcomes in lower-order skills, such as subject-specifc and some interdisciplinary skills. Yet algorithm and AI tools need to be further developed to target the enhancement of learning outcomes in higher-order 'soft skills', global citizenship and other emerging skill sets needed for self-fulflmen t and job markets.

Equally important, the power of AI for sourcing and curating curricular content across languages and platforms needs to be explored to bridge formal, non-formal and informal learning settings, and to support on-the-job reskilling and upskilling in particular. While teachers cannot be replaced by machines, and human interaction between teachers and learners should remain at the core of education, the potentials of AI tools for 'human machine collaboration' should be further mined to support teachers' high-skill pedagogical responsibilities in dif erent learning settings. This section explores the ways in which targeted initiatives are aiming to enhance learning outcomes as well as equipping teachers with the skills they need for both their own professional development and the delivery of quality technology education across contexts.

Focus areas included under this theme are:

- Orientating the use of AI to enhance learning outcomes of students
- Empowering teachers and inclusive teaching practices through AI technologies
- Fostering AI to support life-wide skills development across learning settings

Section 4: Ensuring non-discriminatory and gender-equitable use of AI for lifelong learning

AI of ers new innovations which can be applied in various ways to enable and record lifelong learning achievements. However, the education landscape of ers a diverse set of discriminatory challenges in the feld of AI. The development and use of AI in education must not display or practise bias against any gender, age, minority or vulnerable group. A growing body of evidence shows that many women and girls are excluded from the digital space and are less likely to know how to operate smart devices, navigate the internet, use social media and understand digital safety (UNESCO and EQUALS Skills Coalition, 2019). The gap in digital skills is more severe for people who are older, less educated, poor, or living in rural areas and developing countries, and most severe for women living in these conditions.

Addressing the needs of remote and rural populations and serving the more than 70 million displaced people, including migrants, refugees, asylum-seekers and internally displaced persons is another challenge for education. The UNHCR estimates that in 2020 3.7 million refugee children are out of school, and access to quality education is complicated for many refugees by a shortage of teachers and other educational resources as well as a lack of formal education records and/or inability to transfer credentials between systems (UNHCR, 2019).

This section explores the ways in which targeted initiatives are enhancing female participation, and initiatives which overcome intersectional inequalities more broadly to support lifelong learning opportunities, as well as how AI is supporting migrants and learners in remote and difcult c ontexts.

Focus areas included under this theme are:

- Promoting gender equity in AI use and development
- AI-empowered pedagogies and strategies to address challenges faced by people on the move
- Adopting inclusion as a guiding principle for developing and applying AI for lifelong learning
- Using AI to help lifelong learners connect to relevant content

In addition to this categorization, the writing team completed a thorough rereading of each submission and, where necessary, requested responses to questions of clarity. Careful attention was paid to the description of the initiative, including initiators, supporters and implementers; the problem addressed; how AI is used to promote inclusion; successes and challenges of initiatives; and practical and theoretical issues raised. Initiatives (Note: is a word missing here? “on”?) geographical representation, target benefciar ies and impact were also taken into account.

In addition to a table providing the focus, geographical reach, target benefciar y groups and monitoring and evaluation strategy, each selected initiative is summarized briefy ac cording to the following aspects:

1. What: a description of the initiative
2. Who: initiators, supporters and implementers
3. Why: the problem addressed
4. How: AI for, as and in education
5. Results: successes and challenges

When available, links are also provided to enable further research into the initiative. For some initiatives, no information is available about one of the fv e aspects, in which case the aspect is not included. This applies particularly to the results aspect, for which very few submissions included substantial information. Further assessment is needed to further validate the impact of the initiatives presented in this compendium.

The authors would like to emphasize that this compendium is not intended to endorse or evaluate any of the submitted initiatives. The purpose of the analysis conducted was to enable an accurate snapshot presentation of each initiative based on available data and information, and to classify initiatives and structure the compendium in a way which could be navigated by a broad audience.

SECTION 1: Solidify international cooperation to promote inclusive access to AI and digital innovations

Section introduction

The Beijing Consensus for Artifcial Intelligence in Education calls for "collective actions to promote the equitable use of AI in education … including through sharing AI technology, programmes and resources for capacity-building" (UNESCO, 2019: 9). The consensus seeks improved international and cross-sectoral coordination for the promotion of inclusive and shared benefts aligned to national and international development goals.

Submissions to the #MLW2020 theme "solidify international cooperation to promote inclusive access to AI and digital innovations" respond to this call in diverse ways.

Some focus on the creation of internationally-applicable tools which leverage AI, such as the Smart Ecosystem for Learning and Inclusion (SELI), which seeks to create open and accessible learning resources to improve inclusive teaching and learning, and FramerSpace, a platform that facilitates the co-creation of online courses. Work is also underway to develop open-source software tools to semi-automate curriculum alignment and so improve the responsiveness of education systems.

Other international cooperation ef orts are focused on networks of organizations and/or their products. Team4Tech creates cross-sectoral project teams of non-profts , corporates and volunteers to develop and/or improve technology-based solutions to local challenges, while the Learning Referral Network curates existing open-source literacy applications into a coherent, levelled learning pathway for early and advancing readers.

Initiatives focused on sharing knowledge and best practice include the UNESCO Guidelines for Digital Inclusion and the Toolkit on Digitalisation in Development Cooperation and International Cooperation in Education, Culture and Media, two internationally accessible frameworks to support developers and implementers to improve the relevance and uptake of AI projects and programmes.

Finally, this section includes initiatives which promote online identities and digital participation, such as the International Digital Citizenship Platform and ef orts towards secure digital credentials which can be leveraged across contexts.

Initiative summaries

1.1 SMART ECOSYSTEM FOR LEARNING AND INCLUSION (SELI)	
Implementing agency	University of Easter Finland
Focus	International cooperation for open resources using AI
Geographical reach	International: Universities in eleven countries
Target benefciar ies	Teachers and trainers

What – a description of the initiative

SELI (Smart Ecosystem for Learning and Inclusion) aims to improve inclusive teaching and learning by providing support for the creation of open, universally-designed, accessible learning resources. The project aims to develop a digital platform enabling access to scientifc , educational and multimedia materials for learning to support e-accessibility and e-inclusion of vulnerable groups.

Who – initiators, supporters and partners

The project is coordinated by the University of Eastern Finland, with participating universities in Turkey, Poland, Cuba, Ecuador, Uruguay, Dominican Republic, Bolivia, Brazil and Panama.

Why – the problem addressed

Formal educational systems lack adequate capacity, procedures and tools to address the wide variety of barriers obstructing access to quality education and learning. The diversity of these problems, ranging from social and economic situations, vulnerable populations and a variety of disabilities puts the complexity of providing specifc personalised support beyond the capacity of even well-resourced systems.

How – supporting inclusion

Pedagogical methods and technologies (such as blockchain, global sharing pedagogy, e-inclusion, digital storytelling, fipped learning and educational games) are applied to support a complexity of learning barriers. AI is used to help data analysis to improve existing systems, facilitate access to digital tools, adapt content and help content providers to develop improved learning resources.

Additional information

http://seliproject.org/
http://seli.uazuay.edu.ec

1.2 BALANCING PRIVACY & INDIVIDUALIZATION: UNESCO MGIEP'S INCLUSIVE VIRTUAL LEARNING PLATFORM

Implementing agency	UNESCO MGIEP
Focus	International cooperation for open resources using AI
Geographical reach	International: India, Kyrgyzstan, New Zealand
Target benefciar ies	Teachers and students

What – a description of the initiative

FramerSpace is an indigenous platform that facilitates the delivery of global citizenship education, teacher education and student assessments with embedded socio-emotional learning components at scale. FramerSpace is a co-creation platform that provides building blocks to support the creation of online courses and connects students to peers and creators through tools such as gamifca tion and multi-modal journaling. The platform includes learning analytics for in-depth insights towards learning outcomes with anonymization to protect inclusivity and resist bias.

Who – initiators, supporters and partners

FramerSpace was developed at the UNESCO MGIEP. Roy Saurabh is responsible for the solution architecture.

Why – the problem addressed

Machine Learning models can help facilitate proactive interventions infuencing learning paths of 25 million+ students spread across geography to help bridge the skill gap. However, currently the digital divide contributes to inequalities in data production and access, and international machine algorithms are created from data which is heavily weighted towards developed nations.

How – Supporting inclusion

UNESCO MGIEP, through FramerSpace, is uniquely positioned to create a corpus of education vertical data from Global South users too, making sure that any future research and Machine Learning use cases are inclusive of the voices of students and creators who were previously excluded from the global training data corpus currently available for developers.

Results – successes and challenges

With FramerSpace, UNESCO MGIEP aims to democratize education by providing individualised learning solutions for students across the globe. MGIEP aims to achieve this goal by partnering with National and State governments as well as Ministries of Education to provide access to this unique digital learning platform.

Additional information

https://framerspace.com/
https://mgiep.unesco.org/framerspace

1.3 HOW CAN AI MAKE DIGITAL CURRICULUM ALIGNMENT A REALITY? JOIN THE GLOBAL CONVERSATION

Implementing agency	Collaboration of organisations
Focus	International cooperation for open resources using AI
Geographical reach	International: Kenya, Uganda, Jordan
Target benefciar ies	Education policy makers

What – a description of the initiative

This initiative is developing an open source, interoperable set of tools to improve efcienc y by automating aspects of the curriculum alignment process. The initiative aggregates elements of work undertaken by various organisations in support of this goal, build cohesion among projects, and identify and address gaps.

Who – initiators, supporters and partners

The initiative launched with a sprint convened by Google.org, Learning Equality, Vodafone Foundation, UNHCR, and UNESCO to develop proofs-of-concept for open-source software tools to facilitate semi-automated curriculum alignment. The initiative is part of the UNESCO Call for Innovations.

Why – the problem addressed

In low-resource contexts, there is often a lack of time, personnel, and tools available for the prerequisite step of curriculum alignment. Currently, this is typically done by individual consultants, but this is not a sustainable practice especially in the face of rapidly shifting curriculum needs.

How – supporting inclusion

There is signifcan t potential for AI and machine learning to close current gaps in curriculum development and revision. The initiative will support education processes and curriculum alignment internationally and across multiple contexts. In particular, methods for automating the digitisation of curricula that are often in hard copy or non-machine readable formats will support a wider range of policy stakeholders.

Results – successes and challenges

Progress to date includes creating a rubric to inform how a machine can make curricular alignment predictions, development of a user interface to collect human judgment data to train and improve future machine learning predictions and the development of a user interface to incorporate machine learning recommendations into an overall user journey. A toolkit of resources has been initially developed and a machine learning model is being improved with the help of curriculum experts.

Additional information

https://learningequality.org/r/designsprint-mar19
https://learningequality.org/r/hackathon-oct19-report
http://learningequality.org/r/hackathon-oct19-video
https://alignmentapp.learningequality.org/

1.4 INTERNATIONAL COOPERATION FOR THE DIGITALISATION, TRANSLATION AND LOCALIZATION OF THE UNESCO GUIDELINES FOR DIGITAL INCLUSION

Implementing agency	Fondazione per la Scuola and UNESCO
Focus	Sharing knowledge to improve the quality of AI for education
Geographical reach	International: Worldwide
Target benefciar ies	AI developers and implementers

What – a description of the initiative

The UNESCO Guidelines for Digital Inclusion were produced with the aim of increasing the accessibility of digital and AI-based products and services to vulnerable and low-literacy populations. Through the initiative the Guidelines were translated and localized for an Italian audience and a website for dissemination was developed.

Who – initiators, supporters and partners

Fondazione per la Scuola, the education branch of Compagnia di San Paolo, aims to support school improvement through systemic intervention in Turin, Italy and globally. The initiative was undertaken in collaboration with UNESCO and Conversa.

Why – the problem addressed

As the application of technology-based solutions becomes more widespread, including in low resource contexts, it is increasingly necessary for these solutions to be universally accessible and easy to use even by people with very little education.

How – supporting inclusion

The UNESCO Guidelines website/app detail the steps that digital content developers can take to ensure that their products and services can be used by, and beneft people with low literacy levels and limited technological skills. The website created to disseminate the UNESCO Guidelines is data light, open source and exceptionally easy to edit. This will allow the content to be easily adapted by organizations in non-English-speaking countries who wish to translate, localize, and disseminate the UNESCO Guidelines in their own countries.

Results – successes and challenges

This initiative is an example of how the adaptability and replicability of technological solutions can empower and foster collaboration between international actors around the promotion of inclusive access to AI and digital innovations.

Additional information

https://unesco.conversa-dev.it/en-index.html

1.5 A TOOLKIT: DIGITALIZATION IN DEVELOPMENT COOPERATION AND INTERNATIONAL COOPERATION IN EDUCATION, CULTURE AND MEDIA

Implementing agency	The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ)
Focus	Sharing knowledge to improve the quality of AI for education
Geographical reach	International: Worldwide
Target benefciar ies	Education policy-makers

What – a description of the initiative

The toolkit is a "hands-on" publication that presents innovative methods, approaches and project examples in the feld of ICT for education. It highlights potential and illustrates lessons learned regarding the use of digital tools for teaching, learning and education management. The toolkit also contains practical implementation guidance with check lists, self-tests and toolboxes on specifc methods regarding topics like inclusion, data privacy, digital skills and sustainability.

Who – initiators, supporters and partners

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) commissioned the toolkit on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). Participants include the German Federal Ministry for Economic Cooperation and Development (BMZ), the German Federal Foreign Ofc e, KfW Development Bank, the German Investment and Development Corporation, Deutsche Welle Akademie, Deutsche Welthungerhilfe e.V., the Goethe-Institut, and Gesellschaft für Internationale Zusammenarbeit (GIZ).

Why – the problem addressed

With the help of digital technologies, education programmes can reach more people and educational content and teaching formats can be adapted to students' specific needs and individual contexts. However, despite the broad possibilities, the risks and challenges of the digital revolution must be considered, particularly when it comes to AI and Big Data.

How – supporting inclusion

The toolkit provides good practices as well as lessons learned, and guidance to enhance learning outcomes across learning settings and ensure inclusive and equitable quality education for marginalized groups in vulnerable settings. It acts as a guide for analysing digital options and supports advice with examples from dif erent regions and sectors.

Results – successes and challenges

Through the toolkit knowledge is presented innovatively as a publication. The toolkit inspires education experts from development/intercultural cooperation and increases curiosity about the use of digital technologies. The toolkit is a resource that will be continually updated in line with the participants' experiences.

Additional information

https://www.gfa-group.de/projects/Toolkit_Digitalisation_and_Education_in_Development_Cooperation_ 3918133.html
http://www.bmz.de/en/zentrales_downloadarchiv/ikt/Toolkit-Digitalisation-Development-Education-Culture-Media.pdf

1.6 MUTUALLY RECOGNIZED DIGITAL CREDENTIALS FOR EDUCATION ACROSS BORDERS

Implementing agency	Accredify
Focus	Promoting online identities and digital participation
Geographical reach	National: Viet Nam
Target benefciar ies	Students and education systems

What – a description of the initiative

Accredify's technology combines big data, artifcial intelligence and distributed ledger technology to help education institutions to empower their students by issuing self-notarized credentials that are recognisable globally. Using big data and artifcial intelligence, documents are translated in accordance to ISO 17100 from base language into the language of choice, and particularly English. Thereafter, the data is anchored onto a distributed ledger to make the credential tamper-proof and instantly verifable without an intermediary or a centralized database.

The aim is to make Accredify available to displaced people worldwide, while starting initially in Viet Nam.

Who – initiators, supporters and partners

The EdtTech company Accredify enables institutions to issue tamper-proof digital certifca tes using the OpenCerts Schema.

Why – the problem addressed

Those who successfully complete a degree from an institution must go back to that institution, and usually at a cost, each time there is a need to verify the academic credentials they have earned. This can be a complicated problem, especially if the learner no longer has access to the university or if the learner's home language is not English. This especially af ects the 65.6 million displaced individuals and 4.7 billion people living in countries where English is not an ofcial language .

How – supporting inclusion

Accredify is pursuing a future in which credentials are owned and controlled by individuals rather than institutions, and can be easily transferred across contexts and verifed for authenticity. Using blockchain the initiative seeks to create a future where authenticating credentials is as simple as dragging and dropping a certifca te fle . This initiative will serve vulnerable, displaced and minority populations to enable new opportunities across educational and geographical contexts.

Additional information

https://accredify.io/

1.7 THE INTERNATIONAL DIGITAL CITIZENSHIP PLATFORM

Implementing agency	University of São Paulo
Focus	Promoting online identities and digital participation
Geographical reach	National: Brazil
Target benefciar ies	All citizens

What – a description of the initiative

The International Digital Citizenship Platform (Plataforma Internacional de Cidadania Digital) was launched to provide three main digital ecologies: a content directory, a capacitation application and a WikiCitizenship in which people submit content and projects that have been practiced around the world. The initiative aims to improve skills, awareness and engagement of people in civic life.

Who – initiators, supporters and partners

The Brazilian Group at the University of São Paulo is undertaking the initiative.

Why – the problem addressed

Through network interactions and architectures algorithms, databases, artifcial intelligence and the physical world now infuenc e and are a part of human interaction. As such there is a need to promote skills towards a new civil society which includes these elements.

How – Supporting inclusion

The platform aims to present a feld of research, study and refec tion on the changes provided by Artifcial Intelligence (AI) and digital networks in the citizens' participation in decision-making processes.

Results – successes and challenges

As a new project, the initiative has collected data and created metrics to assess how countries can perform citizen empowerment projects within the platform. The frst attempt joins AI and the SDGs to promote skills towards civil society.

Additional information

https://www.cittadinanzadigitale.com.br/copia-home
https://www.sostenibilia.net/projetoxingu
www.plataformacidadaniadigital.com.br

1.8 THE LEARNING REFERRAL NETWORK

Implementing agency	Curious Learning

Focus	Enhancing existing initiatives through networks and partnerships
Geographical reach	International: Africa and Asia
Target benefciar ies	Learners

What – a description of the initiative

Curious Learning is introducing an ecosystem, called the Learning Referral Network (LRN), which provides the tools needed to learn, starting with learning to read. The LRN is a curated suite of literacy learning apps accessed through a single curation app. Apps are recommended sequentially and deleted in turn to prevent overburdening processors, battery or memory storage.

Who – initiators, supporters and partners

Curious Learning is a non-proft which works with partners to curate, localize, and distribute free open source apps to empower anyone to learn to read. Its "Feed the Monster" app has been localized into 46 languages.

Why – the problem addressed

A proliferation of learning apps has emerged, localized to a multitude of languages. This is coupled with the growing number of smartphones fnding their way into the hands of even those most marginalized and/or impoverished. Great progress has been made in creating and researching mobile apps for learning, including UNESCO-related initiatives such as the Global Learning XPRIZE and the Global Digital Library. Further gains can be made through ensuring a learning pathway through these resources is logical and evidence-based.

How – supporting inclusion

The apps included in the LRN are able to work ofine , are free and can be adapted to dif erent languages easily. Apps in the network are open source, and creative commons licenses allow others to localize the app into other languages, as well as allowing for new teams to use existing content to make new and potentially more ef ective apps in the future. No advertising is accommodated.

Results – successes and challenges

The LRN provides an innovative approach to mobile learning which can complement other initiatives and programmes. Challenges faced by the programme include the lack of a robust evidence base from studies conducted at scale.

Additional information

https://docs.google.com/document/d/1oOx4dSmH_OAdjRaettF0pVUVTLpcl41tG51C4pd_qHs/edit?usp=sharing

https://allchildrenreading.org/wp-content/uploads/2019/07/Feed-the-Monster-Report-Final-Web.pdf

https://www.appriseproject.org/

https://drive.google.com/fle/

d/1kTXCHpMREJvKANhVOsTnfl6Mp_FTBn_T/view

1.9 COLLABORATION FOR INCLUSION: CAPACITY BUILDING FOR LOCAL INNOVATORS AND EDUCATORS THROUGH TECHNOLOGY EXPERTS

Implementing agency	Team4Tech

Focus	Enhancing existing initiatives through networks and partnerships
Geographical reach	International: Cambodia, Rwanda, Uganda, USA
Target benefciar ies	Educators, students, industry and non-profts

What – a description of the initiative

Team4Tech's platform is designed to support corporate social responsibility goals and of er employees a valuable professional development opportunity. Teach4Tech creates partnerships between non-profit organizations, volunteers and corporate partners, which create immersive short-term service learning projects to support educational outcomes and non-profit agenc y goals.

Who – initiators, supporters and partners

Team4Tech is an education non-profit that seeks to expand educational opportunities to underserved students through cooperation.

Why – the problem addressed

AI and digital tools are a means to ef ective communication, creativity, and problem-solving in our world, but intentional collaboration across sectors and countries not often represented is paramount.

How – supporting inclusion

Team4Tech establishes partnerships between local, underserved organisations and technology experts from Silicon Valley. Team4Tech partners with local non-profit organizations for three to fv e years to support them in achieving their own goals through technology integration for education impact. The focus is on building capacity for local access and innovation. Technology grants and training are of ered to build capacity for local non-profit organizations. In addition, a volunteer training curriculum incorporates human-centred design, promotes creative problem solving, and helps volunteers understand emerging markets and cultural contexts.

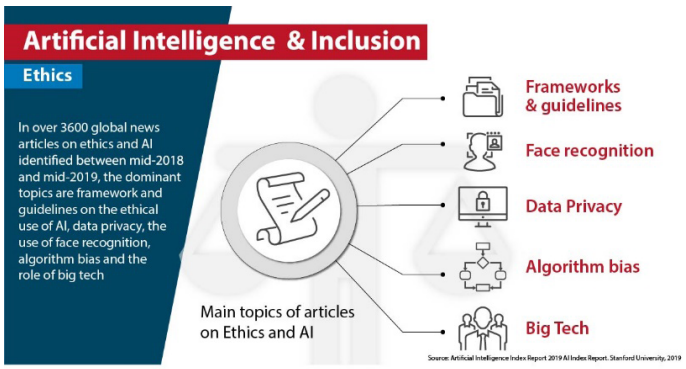
Results – successes and challenges

Since 2013 over 500 Team4Tech volunteers have participated in more than 60 projects, with 65,000 students reached by 25 non-profit partners in 18 countries. As the interventions include local design, outcomes are targeted to community needs and priorities. For example, a community makerspace supported the work of local women in Uganda, while a project in Rwanda developed the frst inno vation hub for young girls.

Additional information

https://www.team4tech.org/projects/project/launching-frst -makerspace-in-the-slums-of-kampala-with-women-in-technologyuganda-witu/

Section conclusions



One of the key challenges facing AI developers and users is ensuring **equitable and ethical** application of AI across contexts, to ensure that the use of AI does not widen existing social and economic divides within and between nations. International and inter-sectoral collaboration will be crucial in leveraging AI to achieve the sustainable development goals, including SGD 4: Quality Education for All.

In addition to the creation of adaptable AI programmes and tools, AI can be used to add value to existing resources. The development of open resources with liberal creative commons licenses creates opportunities across borders to leverage AI for development and educational outcomes. The initiatives in this section have highlighted the potential open resources hold for adaptation to dif erent contexts and languages, while also providing opportunities to build upon prior knowledge and products to further development in the feld of educa tion.

Open knowledge and knowledge sharing provide another crucial component of international collaboration. Sharing of practices across national borders can serve to spark creativity and enable new development or adaptation of existing software, as well as providing evidence of best practices in AI development and delivery. These ef orts can contribute to reducing duplication in the education sector.

Finally, this section has highlighted a few international and national ef orts towards improving the concepts and applicability of digital citizenship, which are important ef orts towards empowering currently disadvantaged populations, particularly displaced individuals.

SECTION 2: Leveraging AI to advance inclusion in access to quality learning opportunities

Section introduction

The initiatives grouped in the second theme, leveraging AI to advance inclusion in access to quality learning opportunities, consist of a range of applications of AI to strategies for management and understanding of various special education needs.

Initiatives which use AI and digital innovations to support learners with disabilities address various types of non-normative development. AI strategies applied to these challenges include identifca tion, investigation of the conditions and exploring innovations to enhance management and improve learning outcomes. Initiatives such as the Global Digital Library, Mathematics and Sounds and StorySign address specifc physical disabilities through the application of AI technology, while initiatives such as Lexplore investigate and make recommendations on specifc developmental delays, and AIDA and PubCoder specifcally address the needs of autism spectrum disorder. Scorina and ADMINS are initiatives which seek to improve education management and related administration for people with disabilities.

Other initiatives in this section focus on AI tools which seek to reduce language barriers and promote literacy education. The Amrita Learning Intelligent Tutoring System, Putonghua teacher and Kumoontun App are initiatives which focus on addressing the needs of speakers of underserved languages and address challenges in learning support materials. Alphatic and the MAAGI Mammies Digital Literacy Project work to improve literacy levels in marginalized populations.

Initiative summaries

2.1 INOUN AND THE GLOBAL DIGITAL LIBRARY: MODELS FOR ONLINE, OPEN AND DISTANCE LEARNING

Implementing agency	International Council for Open and Distance Education (ICDE)
Focus	Using AI and digital innovations to support learners with disabilities
Geographical reach	International: Argentina, Nigeria, Norway
Target benefciar ies	Learners with disabilities
Monitoring and evaluation	Not available

What – a description of the initiative

This initiative consists of two AI tools to augment online learning experiences, with particular focus on learners with disabilities. A web-based virtual assistant chatbot named iNOUN provides human-like responses to academic and general text input enquiries about the National Open University of Nigeria.

The Global Digital Library (GDL) works to increases the availability of high-quality reading resources in underserved languages. The GDL has been working to develop AI-based user experiences for the GDL users by integrating with the Google Assistant API. This allows the reader to speak to a "GDL assistant" including features such as "search for books" and "read books".

Who – initiators, supporters and partners

The International Council for Open and Distance Education (ICDE), is a global membership organization that works towards bringing accessible, quality education to all through online, open and distance learning. ICDE works with the Global Digital Library and Google.

Why – the problem addressed

The objective of the initiative is to provide new learning opportunities for children with disabilities, particularly for visually-impaired children.

How – supporting inclusion

A central challenge for the GDL has been to update and adapt their learning materials to dif erent platforms, so they can include accessibility features for learners with disabilities. The GDL project has also tested with visually impaired users using Google TalkBack. This is an AI-based feature on the Android platform that combines text to speech and structural navigation that allows visually impaired users to navigate the GDL and read books.

The conversational chatbot uses Google's Dialogfo w Natural Language Processing (NLP) framework to provide dialogue interaction with end-users, while the AI component of the GDL leverages Google Bolo.

Results – successes and challenges

The use of AI-based technology is being tested.

Additional information

https://digitallibrary.io/
https://ucaecemdp.edu.ar/posgrado/maestria-en-ciencia-de-datos-e-innovacion-empresarial/kiwi.loria.fr
https://www.slate.uib.no/

2.2 USING AI TECHNOLOGY TO SUPPORT STUDENTS WITH VISUAL DISABILITY IN SCHOOLS

Implementing agency	ONCE (Organización Nacional de Ciegos Españoles - Spanish National Blind Organisation) of the Barcelona Educational Resource Centre
Focus	Using AI and digital innovations to support learners with disabilities
Geographical reach	International: Europe, Latin America
Target benefciar ies	Children with visual disabilities
Monitoring and evaluation	Not available

What – a description of the initiative

This initiative is an application of AI technology to support children with visual disability in ordinary schools and social environments by providing a range of experiences. These experiences demonstrate the potential of AI to increase learning opportunities and facilitate inclusion through improved communication, access to information, orientation and mobility, and general autonomy.

Who – initiators, supporters and partners

The Barcelona Educational Resource Centre is part of the ONCE (Spanish National Blind Organisation).

Why – the problem addressed

The aim is to facilitate the inclusion of blind and partially-sighted students within the educational system in order to ensure that they have the same opportunities as the rest of their classmates. Key to achieving this is the promotion of technology for learning and inclusion.

How – supporting inclusion

AI, specifcally as a virtual assistant, is efficient and effective in facilitating the accomplishment of learning tasks. AI helps to develop autonomy for full inclusion, by facilitating orientation and mobility through route training, using simulation of obstacles, object and face recognition, etc. Access to information is improved by use of the range of available formats, including image, text and voice.

Developers are encouraged to be sensitive to the needs of visually-disabled users through the implementation of Universal Design (W3C-WAI standards and others) when creating AI tools and user interfaces.

Additional information

https://www.once.es/otras-webs/english
https://agora.xtec.cat/credv/
Contact persons: Silvia Boix and Maria Teresa Corbella (sil.boix@gmail.com)

2.3 MATHEMATICS AND SOUNDS: MOBILE LEARNING WITH AUGMENTED REALITY TO IMPROVE INCLUSION OF HEARING-IMPAIRED CHILDREN

Implementing agency	National University of Santiago del Estero

Focus	Using AI and digital innovations to support learners with disabilities
Geographical reach	National: Argentina
Target benefciar ies	Children and students
Monitoring and evaluation	Not available

What – a description of the initiative

The App "Mathematics and Sounds" uses Augmented Reality (AR) technologies for the learning and auditory training of hearing-impaired pre-schoolers with cochlear implants. A mobile-learning multiplatform AR application is being used to facilitate cost-efcien t access to quality learning opportunities for large numbers of learners with physical and cognitive disabilities. "Mathematics and Sounds" uses 2D and 3D-augmented reality visual resources to provide maths learning activities combined with auditory training activities.

Who – initiators, supporters and partners

Dr Susana Herrera is researching the topic in collaboration with the University Paris 8, France.

Why – the problem addressed

Inclusive education has become a signifcan t global objective in the feld of education, with the aim of incorporating children with disabilities into mainstream schools. The development of mobile applications that of er auditory training exercises and introduce basic concepts can contribute to the inclusion of hearing-impaired children in mainstream school.

How – supporting inclusion

Mobile technologies are comparatively easily incorporated into the learning environment due to their low cost, ubiquity, easy connectivity, situated learning, motivation. AR enables the insertion of contextualized information from a real-world scene by means of mobile learning applications, and encourages attention and motivation. This is highly compatible with the learning of hearing-impaired children, who have a more developed sense of sight that improves their visual attention.

Results – successes and challenges

A 2018 review of "mobile systems" and "hearing impairment" found that although there are mobile systems for the learning or auditory training of children with cochlear implants, no work had been done on simultaneous specifc auditory training activities combined with learning activities in some specifc area of knowledge, no learning or auditory training applications used AR interfaces, and only one multi-platform application was found.

2.4 LEXPLORE: LITERACY ASSESSMENT WITH AI

Implementing agency	Lexplore
Focus	Using AI and digital innovations to support learners with disabilities
Geographical reach	International
Target benefciar ies	Deaf children and their families
Monitoring and evaluation	Not available

What – a description of the initiative

Lexplore is a rapid reading assessment tool powered by eye tracking and AI, which aims to help children and schools improve literacy by using eye movements to identify children with reading difculties .

Eye-tracking technology measures when, where, and how children's eyes move in relation to the words they are reading, detecting minor dif erences in the way a child's brain processes text. Audio and eye-tracking recordings are provided for each child through a web-based portal. Assessment for comprehension is included, with recommendations for instruction.

Who – initiators, supporters and partners

The Lexplore methodology was created and developed by researchers from the Karolinska Institute in Sweden, Mattias Nilsson Benfatto and Gustaf Öqvist Seimyr, in their Kronoberg Project, a longitudinal study of reading and writing difculties conducted over the past 30 years.

Why – the problem addressed

Literacy and comprehension is a key to success in education. To ensure all children have the best opportunity to develop their reading skills, schools need objective facts about the child's reading ability and to the of er the right intervention material.

How – Supporting inclusion

Eye movement data and the results of a battery of literacy tests from 3,000 anonymous children in grades 1-3 were used to train machine learning algorithms to recognize correlations between children's eye movements and reading ability. The AI can now be used to predict performance based on eye movement data, reducing the amount of time and resources needed for evaluation of literacy levels.

Aggregated screening data on a dashboard gives a real time overview of progress that can be viewed at district, school, classroom and individual student levels, and can inform placement decisions and resource allocation.

Results – successes and challenges

60,000 children in Sweden and the United States have been screened since 2016 using Lexplore.

Additional information

https://www.lexplore.com/ https://www.lexplore-analytics.co.uk/

https://youtu.be/xWq9hSBF3DI

https://www.youtube.com/watch?v=smJS3Gy1Eqg

https://www.lexplore.se/

2.5 ARTIFICIAL INTELLIGENCE DESIGN FOR AUTISM (AIDA)

Implementing agency	NTTData
Focus	Using AI and digital innovations to support learners with disabilities
Geographical reach	National: Italy
Target benefciar ies	Autistic children and caregivers
Monitoring and evaluation	Not available

What – a description of the initiative

The AIDA (Artificial Intelligence Design for Autism) project is an inclusive solution for children on the Autism Spectrum Disorder (ASD) which aims to understand the education and communication needs of autistic children and provide customized suggestions for teachers, educators and parents. The system includes a kit that collects data about the child and the environment and a mobile app that provides information to parents and educators about the child's status, with suggestions for the best communication techniques and educational tools for specific situations. The app can also be used to give caregivers an overview of the child's learning progress, and to share information with other users and professionals.

Who – initiators, supporters and partners

NTT DATA is an innovation partner headquartered in Tokyo. AIDA is a co-designed AI research project from Digital Entity, an Italian-based NTTData Design Studio.

Why – the problem addressed

Autistic children experience difculties in paying attention, communicating and understanding other perspectives, and they commonly develop skills at a dif erent rate and order to that of other children. People with autism occasionally experience crises that are difcult to understand, accompanied by displays of behaviour that are difcult to address. These challenges af ect learning and development and make it difcult to develop an appropriate educational plan tailored to autistic children's characteristics.

How – Supporting inclusion

AI is used to detect behavioural patterns during the child's daily routine through a kit of sensors and user-provided information. This allows identifca tion of causes of crises, and consequent adaptation of the educational context to individual needs. In this way, AIDA changes the approach to autism, by attempting to adjust the context to child's needs rather than forcing the child to adapt to the context. AIDA can be implemented on a smartphone and is accessible to dif erent economic bands.

Results – successes and challenges

The inclusion of ASD experts from the start of the research was signifcan t, and the dataset built during the research has improved understanding of parameters and variables relevant to the autistic condition and its surrounding environment.

Additional information

https://corinne.solutions/wp-content/uploads/2019/12/Concept.pdf

https://youtu.be/q1FLpe4GvpM https://www.slideshare.net/CorinneSchillizzi/artifcial-in telligence-design-for-autism-a-custom-education

2.6 PUBCODER: AI AND DIGITAL CONTENT MADE ACCESSIBLE FOR AUTISM AND DYSLEXIA

Implementing agency	PubCoder
Focus	Using AI and digital innovations to support learners with disabilities
Geographical reach	International: Worldwide
Target benefciar ies	Autistic and dyslexic learners
Monitoring and evaluation	Not available

What – a description of the initiative

PubCoder is multi-platform desktop software designed to enable authors, publishers and anyone even without coding skills to create highly interactive and engaging ebooks and apps. PubCoder seeks to provide reading access to traditional media for people with disabilities, and has two specifc reading platforms: one for children with dyslexia and another for children with autism.

Who – initiators, supporters and partners

PubCoder S.R.L is an Italian software company with a commitment to EPUB3 fx ed-layout standards.

Why – the problem addressed

The challenge is to build tools that can make content accessible to people who have cognitive or learning disabilities. The population of children to whom the project is addressed is quite large: children with cognitive impairment, children with motor, language, or attention defcits , and children with autistic spectrum disorders.

How – supporting inclusion

The platforms developed for dyslexia and autism use AI to build content through process automation. In the case of autism, AI is able to learn to correctly assign symbols to words. In the case of dyslexia AI automatically "tags" of words to feed readers with a text that can be highlighted in an accessible way. Finally, AI can independently manage self-learning techniques and of er the end-user contents based on reading skill levels.

In addition to the technical solutions, a team of clinical experts and developers created a digital "template" prototype in fx ed-layout content using symbols from Widgit, the most commonly used set of symbols for word translation into visual representations of concepts. The goal is to create a digital bookstore of fx ed-layout ebooks working from the prototype.

Additional information

http://www.libripertutti.it

http://www.mobidys.com/le-format-frog

http://epubsecrets.com/fx ed-layout-epub3-accessibility-made-possible-in-a-rather-unconventional-way.php

2.7 LEARNING MANAGEMENT SYSTEM "SCORINA"

Implementing agency	UNESCO/ UNEVOC
Focus	Using AI and digital innovations to support learners with disabilities
Geographical reach	National: Republic of Belarus
Target benefciar ies	People with special needs
Monitoring and evaluation	Not available

What – a description of the initiative

This initiative is a distance learning management system that provides inclusive education for people with special needs. The system under development will allow for the implementation of a fully-fedged educational process at any level. The system allows education to be undertaken remotely, for both intermediate and fnal certifca tion, and provides for expanding educational opportunities for people with special needs.

Who – initiators, supporters and partners

The project is under the UNESCO Chair of Professional Education in the Field of Information and Communication Technologies for Persons with Special Needs at the Institute of Information Technologies of the Belarusian State University of Informatics and Radio Electronics.

Why – the problem addressed

The intention is to improve accessibility of IT education for people with special needs by using ICT and mobile technologies; to scale up IT literacy among youth and adults, taking into account the special needs of people with disabilities, and using their potential to promote social and economic transformation.

How – supporting inclusion

The system contains various modules using innovative solutions, such as a support module implemented through machine learning; a module for the visualization of virtual laboratory layouts and installations; and a performance monitoring module that monitors statistics for passing control tests, analyses these and indicates weaknesses. In parallel, training content in the feld of information and communication technologies is being developed.

Results – successes and challenges

The system is currently under development and will be introduced for the education of people with special needs at the Institute of Information Technologies of the Belarusian State University of Informatics and Radio Electronics.

Additional information

www.iti.bsuir.by/user/info/51

www.iti.bsuir.by/unesco

2.8 ADMINS: DEVELOPING AN AI-POWERED ASSISTANT TO OVERCOME BARRIERS IN DISABILITY DISCLOSURE AND ACCESS TO SUPPORT

Implementing agency	The Open University
Focus	Using AI and digital innovations to support learners with disabilities
Geographical reach	Regional: United Kingdom
Target benefciar ies	Students with special needs
Monitoring and evaluation	Not yet evaluated

What – a description of the initiative

The ADMINS project aims to address inequities faced by those with barriers to learning as a consequence of disabilities. The virtual assistant, "Assistance to the Disclosure and Management of Information about Needs and Support" (ADMINS), harnesses the power of AI to amplify human capacity for those with special needs and disabilities.

Who – initiators, supporters and partners

The Institute of Educational Technology at the Open University leads the ADMINS project, which is funded by Microsoft through their AI for Accessibility initiative.

Why – the problem addressed

Students with disabilities often struggle with static and complicated processes, explaining their needs and getting support. Through research, ADMINS has

identifed how forms and administrative processes create barriers to getting appropriate support for study and independent living. For students, this can have a variety of impacts, including reducing the chance of success.

How – supporting inclusion

The work-in-progress ADMINS virtual assistant leverages Artifcial Intelligence to advance inclusion in access to quality learning opportunities. The ADMINS project will create a chatbot assistant to enable more efcien t and ef ective access to support for people with disabilities. Students with disabilities can provide and receive information via spoken or written dialogue, while the chatbot builds a profle and provides support suggestions.

Results – successes and challenges

A beta release of the ADMINS assistant is now ready for testing with students. The analysis of multiple forms of data from existing disability support processes has been used to inform the design and train the assistant.

Additional information

https://iet.open.ac.uk/projects/admins
https://www.microsoft.com/en-us/ai/ai-for-accessibility-projects

2.9 AMRITA LEARNING INTELLIGENT TUTORING SYSTEM (ITS)

Implementing agency	Amrita
Focus	The use of AI tools to reduce language barriers and promote literacy education
Geographical reach	National: India
Target benefciar ies	Children with special needs, rural poor and disadvantaged
Monitoring and evaluation	Not available

What – a description of the initiative

Amrita's ongoing research into reading difculties and dyslexia in the Malayalam language has produced prediction models that identify children at risk of reading difculties based on longitudinal data from Amrita Learning, an Intelligent Tutoring System (ITS). The ITS uses prediction models to present a customized learning pathway and opportunities for individualized skill practice, targeting children experiencing reading difculties and dy slexia in the Malayalam language.

A second initiative, the AmritaRITE (Rural India Tablet-enhanced Education) literacy app, integrates a quadrant-based direction checking system and machine learning algorithms to provide feedback on handwritten characters in nine Indian languages.

Who – initiators, supporters and partners

The Amrita Center for Research in Analytics, Technologies & Education (AmritaCREATE) is an educational technology initiative pioneered by Amrita Vishwa Vidyapeetham, a teaching and research institution in India. AmritaCREATE has collaborative alliance with several government agencies, industrial and international partners, including Dr Joost Monks.

Why – the problem addressed

Many children with disabilities are underserved in the education system, particularly those in low-income settings. Several factors contribute to failure to conduct early screening of students for reading difculties . These include lack of awareness and understanding of learning difculties , the shortage of special education teachers, and concerns about labelling the child.

How – supporting inclusion

Educational software adapts assessment and instruction based on the child's responses. Various algorithms such as logistic regression, decision trees, neural networks, random forests, k-NNs, and SVMs are evaluated for the identifca tion of at-risk students.

Results – successes and challenges

Results indicate that combining the ITS score with formative assessment scores improves the accuracy of the identifca tion of at-risk students.

Additional information

www.amrita.edu/create
www.amrita.edu/rite

2.10 PUTONGHUA TEACHER: IMPROVING LITERACY, PRESERVING LANGUAGE

Implementing agency	Tomorrow Advancing Life Group
Focus	Use of AI tools to reduce language barriers and promote literacy education
Geographical reach	National: China
Target benefciar ies	Chinese Yi children
Monitoring and evaluation	Externally evaluated

What – a description of the initiative

The AI "Putonghua" Teacher is an app that allows Chinese Yi children and others from all backgrounds access to Mandarin language learning resources and tools. The project focuses on improving the overall literacy rate through using AI speech recognition and big data to increase opportunities for further inclusivity and social mobility within these rural communities.

Who – initiators, supporters and partners

The Tomorrow Advancing Life Group (TAL) is a technology-driven education and technology enterprise in China. TAL collaborates with universities and research institutions such as Peking University, Tsinghua University, Beijing Normal University and China Children's Center.

Why – the problem addressed

A large percentage of the 9 million Yi people in China live below the absolute poverty line and with a literacy rate of 26.4%. The initiative is intended to help preserve the Yi language while connecting the communities to the outside world.

How –supporting inclusion

The program applies the AI Mandarin teaching system and integrates an extensive voice database and localized learning content with education and training to empower ethnic minority teachers. The low-cost, low-tech solution helps teachers and students in remote areas using AI speech recognition and big data, providing users with pronunciation and grammar corrections in real-time.

Results – successes and challenges

The programme covers 252 teaching centres and 72 primary schools, engaging 2,417 teachers and 70,462 students. A survey of programme participants indicated that 97% of the teachers think the system helps students improve their Mandarin vocabulary and comprehension. Ninety-three percent of teachers think the AI teaching system has improved students' scores, and 89% think the system helps improve students' performance in other subjects.

Additional information

https://aiteacher.100tal.com

2.11 KUMOONTUN APP FOR LEARNING AYÖÖK, OAXACA, MEXICO

Implementing agency	Kumoontun A.C., Marco Antonio Martinez
Focus	Use of AI tools to reduce language barriers and promote literacy education
Geographical reach	National: Mexico
Target benefciar ies	The Ayöök community
Monitoring and evaluation	Not available

What – a description of the initiative

Kumoontun is an app to translate Ayöök, one of 364 indigenous Mexican languages spoken by around 130,000 people, into Spanish and English. It has been utilized by teachers in schools as a teaching tool and introduction of technology to children.

With the use of social networks, digital platforms and the Kumoontun application, digital content is created to preserve the linguistic diversity of the region, while at the same time supporting literacy learning in Ayöök, Spanish and English. Workshops are also offered to overcome community resistance to the unfamiliar mobile technology.

Who – initiators, supporters and partners

Kumoontun A.C. is a non-profit civil association that supports cultural projects in the original communities of the Sierra Mixe of Oaxaca. Kumoontun A.C. receives support from the National Commission for the Development of Indigenous Peoples of the Mexican Federal Public Administration.

Why – the problem addressed

On realising that the native languages were disappearing, a solution was proposed to remedy an apparent lack of interest in the Ayöök language, insufficient attention being given to teaching it in the schools, and loss of oral story tradition in the communities.

How – supporting inclusion

Technology plays an important role in cultural preservation by allowing digitisation of information, preventing it from being lost. The initiative has brought together community actors including children, teachers, local authorities and government.

Additional information

https://kumoontun.wixsite.com/kumoontun
https://www.brut.media/mx/news/un-app-para-inmortalizar-la-lengua-ayook-8ceb4112-86fb-4141-8657-68193bbf3b7b
https://www.reporteindigo.com/documento-indigo/kumoontun-luchan-por-preservar-la-lengua-mixe-familia-oaxacaaplicacion-movil/

2.12 ALPHATIC AND THE MAGGI MAMMIES DIGITAL LITERACY PROJECT

Implementing agency	UNESCO
Focus	AI tools to reduce language barriers and promote literacy education
Geographical reach	National: Côte d'Ivoire
Target benefciar ies	Illiterate women
Monitoring and evaluation	Not available

What – a description of the initiative

Alphatic is an adult literacy application developed by a young female Ivoirian programmer. It is deployed as part of the MAGGI Mammies Digital Literacy Project programme and targets illiterate women selling products in open markets, in order to build critical skills in reading, calculation and digital literacy. Developing these skills enables greater independence and allows women to take charge of their families and professional lives.

Who – initiators, supporters and partners

The MAGGI Mammies Digital Literacy Project is a public-private collaboration between Nestlé Côte d'Ivoire and UNESCO. It is implemented with the support of the Ministry of National Education, Technical Education and Public Service; the Ministry Women, Family and Children; the Côte d'Ivoirian start-up BNA DEV Studio; and TKC Consulting.

Why – the problem addressed

Technology solutions can contribute to women's empowerment and economic development through an approach that takes into account local realities. The goal is to help improve the lives of vulnerable women and their families, improving their income, while raising their self-esteem and self-confidence through basic literacy training.

How – supporting inclusion

Mammies are provided with a smartphone that includes Alphatic, and can access the application at their convenience and progress through numerous stages of literacy training. Individual progress is tracked on a dedicated platform and participants gather weekly for in-person support by trained coaches.

Results – successes and challenges

Of 520 identified illiterate women, 435 have been able to complete their training and know how to use their laptops, and can read, write and calculate. Twenty-six young literacy workers were trained and deployed, and the project encouraged the creation of an NGO focused on literacy through digital technology. Additionally, the Ivoirian Government now has a manual and a digital literacy guide on a training approach.

Additional information

https://fr.unesco.org/feldofc e/abidjan
https://www.nestle-cwa.com/en/media/newsandfeatures/partnership-to-improve-women-livelihood

Section conclusions

Inclusive uses of AI have the potential to address the needs of typically underserved populations such as those with disability or developmental delays. The initiatives in this section have demonstrated some of the ways in which AI can benefit the educational outcomes of students with physical disabilities and those with atypical or delayed development. AI can support the care and education of these individuals through screening, improving educational access, collecting and analysing data, recommending management strategies and providing personalised learning pathways.

This section also highlighted AI initiatives which address literacy and linguistic minorities, another demographic that often faces barriers to both quality education and social and economic opportunities. AI such as chatbots and language learning apps and games are being deployed to address the needs of minority language speakers in countries as diverse as China, Côte d'Ivoire, India and Mexico. Through these efforts, previously marginalized populations can gain access to new social, educational and work opportunities.

SECTION 3: Fostering AI innovations to enhance learning outcomes across learning settings

Section introduction:

AI innovations have the potential to transcend the narrative of access to address issues of quality education and tackle the current learning crisis. AI can have a positive impact on the enhancement of learning outcomes. While human interaction between teachers and learners should remain at the core of education, tools for "human machine collaboration' should be further mined to support teachers" high-skill pedagogical responsibilities in dif erent learning settings.

This section covers initiatives that foster AI innovations aimed at enhancing learning outcomes across learning settings. A number of initiatives further deal with teacher development and classroom applications. Wamda, the Innovation Studio and Collabrify Roadmap Platform are initiatives which enable teacher development through and/or in technology and its pedagogical applications, and WatsomApp is an AI and robotics tool to assist teachers in identifying learners with psychosocial needs.

Finally, some initiatives provide more specifc digital tools for use in the education environment. The LEGO Virtual Robotics Toolkit enables teachers without access to physical kits to engage learners in robotics, and mSchools provides tools and resources for teaching AI and related content. The Entrepreneurial Project of Digital Web Coding Art Creativity programme support both AI-related training and entrepreneurship and design thinking, providing opportunities for students to engage in the development of technological solutions to community problems. I

Initiative summaries

3.1 RUMAH BELAJAR

Implementing agency	Education and Culture Information and Communication Technology Center, Ministry of Education and Culture, Indonesia
Minor theme	Orientating the use of AI to enhance learning outcomes of disadvantaged groups
Geographical reach	National: Indonesia
Target benefciar ies	Teachers and students
Monitoring and evaluation	Not available

What – a description of the initiative

Rumah Belajar ("learn to learn") is an online learning platform which provides learning materials and communication facilities to support interaction between communities, students and teachers through engaging and interactive media. Interactive learning materials include images, animations, videos and simulations, digital books, cultural maps, examination resources, literature and language resources and a worldwide telescope. The platform further supports engagements through virtual laboratories, virtual classes and open and distance learning.

Who – initiators, supporters and partners

Rumah Belajar is a government initiative sponsored and implemented through the Ministry of Education and Culture of Indonesia.

Why – the problem addressed

Indonesia has a population of almost 270 million spread over 17,000 islands, with a school-aged population of around 50 million. About 10% of school-age children (7- 18 years) are currently not accessing education services. The geographical divides, disparity in access to education, low number of qualifed teachers and poor learning infrastructure are challenges to providing equitable educational opportunities.

How – supporting inclusion

Rumah Belajar is a free and accessible resource for all levels of education. The platform provides a Learning Management System to facilitate the process of virtual learning, teaching materials presented in a structured manner, an interactive laboratory simulation, and a question bank that includes student evaluation materials grouped by teaching topics. An upgraded version of Rumah Belajar in development includes gamifca tion features, further implementation of machine learning and AI, and more interactive media.

Results – successes and challenges

Internet access has not impeded the use and reach of Rumah Belajar. Even teachers in the outermost and underdeveloped regions of the country are able to carry out the learning process with material taken from Rumah Belajar.

Additional information

https://belajar.kemdikbud.go.id/

3.2 ORÁCULO MATEMÁGICO: DIGITAL ECOSYSTEM FOR IMPROVING THE LEARNING OF MATHEMATICS IN PERU'S RURAL AND LOW-INCOME URBAN AREAS

Implementing agency	Fundación Telefónica del Perú and Pontifcia Univ ersidad Católica del Perú

Focus	Orientating the use of AI to enhance learning outcomes of disadvantaged groups
Geographical reach	National: Peru
Target benefciar ies	Primary school student, teachers and managers
Monitoring and evaluation	Externally evaluated

What – a description of the initiative

The Oráculo Matemágico is a digital ecosystem aimed to improve mathematics learning in rural and low-income urban areas of Peru. Oráculo Matemágico engages primary school students through gamifca tion and storytelling. The initiative also supports better learning management using AI and data analytics.

Who – initiators, supporters and partners

Fundación Telefónica is an international telecommunications company that aims to improve development opportunities through projects adapted to the challenges of the digital world.

Pontifcia Universidad Católica del Perú is an academic institution of ering guidance and support to the project.

Why – the problem addressed

The initiative seeks to address challenges of poor learning outcomes specifcally in the area of primary school mathematics in Peru.

How – supporting inclusion

The initiative is a replicable, freely accessible and highly versatile approach to education. The digital ecosystem comprises a free downloadable multi-platform mobile app (Android, Windows, Linux), a certifed online course for teachers, and an AI-based report management platform that allows users to adapt and create content according to teachers' and students' needs. The ofine solution improves access in rural areas and low income urban areas that might have poor connectivity.

Results – successes and challenges

Annually, the programme benefts around 400,000 public school students in its online and ofine (Solución Profuturo) versions. A mixed-methods evaluation showed signifcan tly higher mathematics achievement for intervention students. In addition, teachers considered that use of the application helped students' classroom motivation and interest.

Additional information

https://www.youtube.com/watch?v=WkRPO-7HkBs
https://www.youtube.com/watch?v=Lod1ldc1G4o
http://oraculomatemagico.educared.fundaciontelefonica.com.pe/

3.3 WAMDA

Implementing agency	Dr. Athra Alawani of Hamdan Bin Mohammed e-University
Focus	Empowering teachers and inclusive teaching practices through AI technologies
Geographical reach	National: United Arab Emirates
Target benefciar ies	Teachers
Monitoring and evaluation	Internal evaluation

What – a description of the initiative

Wamda is a smart mobile and social learning platform that provides professional development for teachers in United Arab Emirates (UAE). The platform provides learning resources through emerging technologies as well as social networking features to motivate teachers and encourage active participation. A course focused on the use of virtual reality encourages teachers to create engaging technology-based lessons.

Who – initiators, supporters and partners

The initiative was developed by Dr. Athra Alawani of Hamdan Bin Mohammed e-University with the assistance of technical experts. It is supported by the UAE Ministry of Education and Mohamed Ally of Athabasca University in Canada.

Why – the problem addressed[3]

The UAE faces challenges in ensuring that teachers are well-trained and capable of delivering currently relevant skills. Teachers must be able to manage a range of learning situations and apply various teaching practices fe xibly and fuen tly to address the needs of students and changing aspects of society.

Gaps remain in the UAE in terms of actualising teacher professional standards. Advancements in technology can provide both useful resources and new approaches for teacher development.

How – supporting inclusion

Wamda seeks to ensure availability of efcien t and reliably trained teachers in UAE public schools by using technology to deliver teacher professional development programs to enable teachers to meet professional standards. The course encourages teachers to redesign their teaching practice and create exciting and purposeful learning experiences for students using virtual reality Google Tour Creator (GTC).

Results – successes and challenges

Wamda is being piloted to evaluate the content, system and outcomes. An internal evaluation of the pilot showed that teachers fnd Wamda to be a promising system with the potential to impact learning and education reform.

Additional information

https://www.learntechlib.org/p/207760/

Darshan Singh, A., S. Raghunathan, E. Robeck, and B. Sharma. 2018. Cases on Smart Learning Environments. Advances in Educational Technologies and Instructional Design (2326-8905). IGI Global. https://books.google.co.za/books?id=MOh_DwAAQBAJ.

3.4 INNOVATION STUDIO

Implementing agency	Varkey Foundation
Focus	Empowering teachers and inclusive teaching practices through AI technologies
Geographical reach	National: Argentina
Target benefciar ies	Teachers
Monitoring and evaluation	Not available

What – a description of the initiative

The Innovation Studio is a face-to-face learning experience which enables educators to experiment with dif erent digital tools in a safe and collaborative environment, promoting the meaningful use of technology at schools. A series of innovation sessions are guided by EdTech experts and can easily be implemented by any school, including those in low-income and rural contexts.

3 Information in this section was drawn from: Alawani, A.S. 2019. Wamda: A smart mobile learning system for UAE teachers. *IGI Global* [online]. https://www.igi-global.com/chapter/wamda/219027

Who – initiators, supporters and partners

The Varkey Foundation is a global charity foundation that supports quality education for all children through improving educator capacity.

Why – the problem addressed

In an increasingly connected world, digital skills are critical for social inclusion. The Foundation works to build teachers' digital skills to promote inclusive and equitable education opportunities for all children.

How – supporting inclusion

The initiative engages teachers in developing digital tools such as coding, robotics, virtual and augmented reality and 3D printing, and enables teachers to create meaningful educational experiences linked to technology for their students.

The model enables personalized learning to be derived from individual students' digital footprints. Variables such as the time a particular student has spent watching prescribed videos are used to identify students that are likely to watch full videos. Students' behaviour on the digital platform is analysed to improve personalized learning experiences.

Additional information

https://youtu.be/nFMrFPk5150
https://youtu.be/m7QySzdlGW0
https://youtu.be/3XecLqTI63g

3.5 COLLABRIFY ROADMAP PLATFORM

Implementing agency	Intergalactic Mobile Learning Center
Focus	Empowering teachers and inclusive teaching practices through AI technologies
Geographical reach	National: USA
Target benefciar ies	Teachers and students
Monitoring and evaluation	Not available

What – a description of the initiative

The Collabrify Roadmap Platform is a free browser-based visual environment that supports teachers to manage the full life-cycle of digital lessons (create, distribute, enact, assess, and share) and support students as they enact digital learn-by-doing lessons, all the while developing a metacognitive skill of self-regulated learning and emphasizing social learning through collaboration. Collabrify also of ers Open Education Resource (OER) digital class projects in science, math and social studies.

Who – initiators, supporters and partners

The Intergalactic Mobile Learning Center (IMLC) is an initiative of the University of Michigan and the University of North Texas to develop collaborative educational tools for students and facilitate social learning in and out of the classroom.

Why – the problem addressed

Ef ective teaching in the context of a dynamic and diverse society requires fe xible curriculum delivery. Teachers need improved understanding of their students' changing needs to customize curricula and instruction. AI has the potential to empower teachers to manage classrooms ef ectively, both socially and academically.

How – supporting inclusion

Collabrify applications enable teachers to create interactive digital lessons called Roadmaps. Roadmaps can use video, information from websites and simulations as well as constructive activities such as writing, concept mapping and drawing. Activities can be undertaken individually, or students can collaborate. Machine learning algorithms analyse a student's actions to provide real-time feedback to the classroom teacher via a dashboard and text-messages to the teacher's smartwatch so teachers can adapt their lessons to address the dif ering needs of their learners more ef ectively.

Results – successes and challenges

To date over 600 students including children in low income schools and those with learning disabilities from 12 schools in Michigan are using these digital materials on a daily basis.

Additional information

https://cdc.engin.umich.edu/
https://goopenmichigan.org/curated-collections/38
https://roadmap.center
https://thejournal.com/articles/2018/02/26/how-to-manage.aspx

3.6 WATSOMAPP

Implementing agency	KIO Artifcial I ntelligence S.L.
Focus	Empowering teachers and inclusive teaching practices through AI technologies
Geographical reach	National: Catalonia
Target benefciar ies	School teachers
Monitoring and evaluation	Not available

What – a description of the initiative

WatsomApp is an initiative to help educators reduce bullying in their schools. Students engage an ICT-based game and a talking humanoid robot. Accurate data analysis enables teachers to improve their strategies for tackling psychosocial issues in the classroom, with the aim of ensuring the full participation and educational success of every pupil and fostering inclusion.

Who – initiators, supporters and partners

KIO Artifcial Intelligence S.L. is a Spanish company specializing in AI solutions. WatsomApp was created through a partnership with IBM and IBM technology. The pilot is implemented with the support of the Ministry of Education of Catalonia: Directorate of Innovation, Research and Digital Culture.

Why – the problem addressed

Bullying behaviour is largely invisible to parents and teachers, but children who suf er from physical or psychological harassment can become isolated and anxious, harming their mental health and inhibiting their education. The rise of social media and the ubiquity of smartphone ownership among young people magnify the negative ef ects of bullying.

How – supporting inclusion

The game and robot combination encourages free, confden t interactions for pupils lacking social skills. The AI solution uses Watson Natural Language Classifer technology, consisting of a chatbot powered by Watson Assistant technology. Robots can recognize images and talk with pupils thanks to IBM Watson Visual Recognition, IBM Watson Speech to Text and IBM Watson Text to Speech technology.

Results – successes and challenges

3,000 students at a school in Spain are interacting with WatsomApp regularly. Following positive feedback, the company aims to make the platform available to more schools across the country and around the world.

Additional information

https://www-03.ibm.com/press/es/es/pressrelease/55622.wss

3.7 LEGO VIRTUAL ROBOTICS TOOLKIT

Implementing agency	IdeasGym
Focus	Fostering AI to support life-wide skills development across learning settings
Geographical reach	National: Egypt
Target benefciar ies	Learners and teachers
Monitoring and evaluation	Internal monitoring

What – a description of the initiative

The Virtual Robotics Toolkit helps to teach kids coding through robotics. Participants use virtual sensors as touch sensor, ultrasonic, and colour sensor to control their virtual robot. The implementation of the project is supported by an interactive platform which connects mentors and students in support of project goals.

Who – initiators, supporters and partners

IdeasGym is an Egyptian company which provides training and mentorship in support of STEM felds . The initiative is rolled out in partnership with Cogmation, a Canadian-based company which created and markets the Virtual Robotics Toolkit, simulation software that enables participants to build LEGO MINDSTORMS robots virtually.

Why – the problem addressed

There is a growing need for students to understand and engage AI that is not currently supported in many classrooms and curricula. Even when AI is used in education, most solutions do not assist students in understanding AI itself.

How – supporting inclusion

The Virtual Robotics Toolkit develops skills in a simulated environment that are easily transferable to real-life environments. Training is provided online for 12 weeks in Arabic or English for school students and/or teachers, culminating in a competition for participating students. Webinars and direct interactions provide opportunities for participants to ask questions and engage facilitators, and also to learn from peers. Technology hubs available throughout the country were leveraged in order to improve access to disadvantaged groups.

Results – successes and challenges

The initiative is internally evaluated through feedback from students and teachers. Main fndings include a high pedagogical value and support for STEM felds , and that the project supports teachers with no robotics expertise.

The platform won frst place in the Egyptian Ministry of Communication and UNDP Woman in ICT category in 2018 and was selected by Xedu and United Nations Technology Innovation Lab in Finland as a solution for emerging markets. The Virtual Robotics Toolkit course also won second place in the DigiEduHack Espoo in 2019.

Additional information

https://elearning.ideasgym.com/catalog/info/id:137
https://www.youtube.com/watch?v=sKD71vaaKZw
https://network.changemakers.com/challenge/future-skills/screening/ideasgym-advanced-learning-platform-for-building-technology-capacities
https://www.youtube.com/watch?v=EA6ep_RFFfQ

3.8 MSCHOOLS

Implementing agency	GSMA
Focus	Fostering AI to support life-wide skills development across learning settings
Geographical reach	National: Catalonia, Spain
Target benefciar ies	Teachers and learners
Monitoring and evaluation	Not available

What – a description of the initiative

mSchools provides tools to teach students AI literacy from an early age. The initiative provides 30 hours of classroom content in which students learn how AI programs use machine learning to learn and evolve by playing games and conducting experiments using their mobile phones as tools for scientifc exploration and discovery. The content is divided into three teaching units with interdisciplinary lessons. Students learn about linguistics, poetry, art, statistics, computational thinking and so on by creating algorithms, programming basic AI simulations and refec ting on the presence of AI in their daily lives.

Who – initiators, supporters and partners

mSchools is an mEducation programme of Mobile World Capital Barcelona, in partnership with Generalitat of Catalonia, Barcelona City Hall and the GSM Association, an industry organization that represents the interests of mobile network operators worldwide. The content for mSchools was created in collaboration with the Barcelona Supercomputing Centre, an international research centre of excellence in Spain.

Why – the problem addressed

In order for AI technologies to enhance quality of life and ameliorate socio-economic injustices around the world, they must be steered by a humanistic vision, which begins with preparing students to be AI-literate from an early age.

How – supporting inclusion

mSchools seeks to empower students for inclusion in a digital society through engagements in learning with mobile technology, improving digital skills and entrepreneurship and creating an open environment for mEducation. mSchools undertakes a number of initiatives including the repository of content which is readily available and free to download in English, Spanish and Catalan; provision of curriculum-based Science, Technology, Engineering, Art and Mathematics (STEAM) modules and teacher support resources; and awards for students and innovative teachers.

Additional information

https://msteam.mschools.com/?lang=en
https://msteam.mschools.com/library?lang=en
https://mschools.com

3.9 ATLAS AND LOGOS: ADAPTIVE ELEARNING THROUGH AI

Implementing agency	Cognostics AG

Focus	Leveraging AI tools and open resources to promote student engagement and improve learning outcomes
Geographical reach	International: Austria, Germany, Europe, North America, Singapore
Target benefciar ies	Students, companies, NGOs
Monitoring and evaluation	Not available

What – a description of the initiative

ATLAS is an adaptive eLearning system that uses AI to provide a personalized learning experience for students. ATLAS is content specifcally designed to facilitate module-based teaching.

LOGOS is a suite of cognitive tools able to generate uniqueprofles as a basis of tailored recommendations that go beyond statistical analysis and take into account the unique requirements of each user.

Who – initiators, supporters and partners

Cognostics AG is a spin-of of the Parmenides Foundation, a centre for interdisciplinary basic and applied research on human thinking and cognition.

Why – the problem addressed

Lifelong learning, including outside of academic institutions, is becoming more and more important in an ever more complex environment. Yet student engagement and quality of learning outcomes are challenges for conventional MOOCs.

How – supporting inclusion

ATLAS and LOGOS use advanced cognitive profling to determine the thinking style and cognitive ability of each student. Knowledge graphs provide an overview of complex knowledge spaces. Individual learning paths are calculated for each user to engage with each of the concepts in the order best suited to their prior knowledge and past interaction with the graph. In addition to highlighting the user's progress, the graph also indicates areas where new concepts are being added. It therefore becomes a constantly evolving representation of knowledge and capabilities.

Additional information

https://www.cognostics.de/products/atlas

3.10 THE ENTREPRENEURIAL PROJECT OF DIGITAL WEB CODING ART CREATIVITY

Implementing agency	Ministry of National Education, Technical Education and Vocational Training, and Institute of Francophonie for Education and Professional Training, Côte d'Ivoire

Focus	Fostering AI to support life-wide skills development across learning settings
Geographical reach	National: Côte d'Ivoire
Target benefciar ies	Teachers and learners
Monitoring and evaluation	Not available

What – a description of the initiative

The initiative aims to provide the entire Ivorian education system with training to equip students to fnd ethical and sustainable solutions to school, family or community issues through the creation of entrepreneurial projects. Through the project, students learn to develop school applications; develop dynamic and educational websites; develop software; and create and present activities, products and services via the web.

Who – initiators, supporters and partners

The initiative is part of the introduction of entrepreneurial education in the Ivorian education system. The "Web Art Creativity" component is a competition initiated by the School Life Department of the Ministry of National Education, Technical Education and Vocational Training. The initiative is supported by the International Organization of La Francophonie through the Institut de la Francophonie for education and training.

Why – the problem addressed

Entrepreneurship is a growing focus of many education systems, as it provides opportunities for students to engage a range of currently in-demand skills such as creative thinking, problem-solving, collaboration and planning. It is important to introduce elements of design

thinking into practical and cross-curricular activities, and to introduce digital elements such as AI, coding and robotics.

How – supporting inclusion

The project uses artifcial intelligence to develop and create innovative technological solutions following the methodology of entrepreneurial education. One component of the project is the training of teachers and students in coding. In this project, coding constitutes a vector for improving learning and preparing young people for artifcial in telligence professions.

3.11 A FINNISH INNOVATION ECOSYSTEM PROJECT

Implementing agency	University of Helsinki, Finland

Focus	Leveraging AI tools and open resources to improve learning outcomes
Geographical reach	National: Finland
Target benefciar ies	Education eco-systems
Monitoring and evaluation	Externally evaluated

What – a description of the initiative

The project promotes the concept of a multilevel educational ecosystem as a support for the 2030 Agenda for Sustainable Development and its ef ort to universally eliminate poverty. In particular, the project aims to promote system-wide frameworks that support equity and quality learning in dif erent contexts. AI models the factors of a good school climate for students' social-emotional wellbeing and cognitive learning outcomes, with the aim of reducing risks of exclusion, enhancing wellbeing, improving opportunities for personalized learning, and improving learning outcomes.

Who – initiators, supporters and partners

The project was co-created by a collaboration of Finnish researchers, practitioners, companies and a national funding agency. The initiative is presented by Dr. Hannele Niemi and Päivi Kousa at the University of Helsinki.

Why – the problem addressed

Educational ecosystems have units at dif erent levels such as institutional- or community-level structures and social practices. At each level, a cooperative sharing culture is a basic condition for inclusive and quality education. AI can be brought to bear on the characteristics of these ecosystems to address persistent problems, such as drop-out and lifelong learning.

How – supporting inclusion

In the lifelong learning project, human-machine interactive AI tools with augmented reality, adaptive intelligent tutoring, and game-based simulations are applied to the learning of demanding, skill-based tasks in vocational education and working life. AI-related tools create new understandings about human-machine interaction and support dif erent learners who might never develop these skills without AI tutoring.

Results – successes and challenges

The project was evaluated by Business Finland (the Finnish National Funding Agency) as a co-innovation project. The focus is on a cooperation of companies and researchers in Higher education for innovations.

Additional information

https://www.helsinki.f/en/net works/educational-ecosystems-for-equity-and-quality-of-learning/unesco-chair-hannele-niemi
https://blogs.helsinki.f/t ekoalyoppimisessa/

3.12 THE DIGITAL INNOVATORS (DI) COLLABORATIVE DEVELOPMENT PROGRAMME

Implementing agency	Science Resources Africa (SRA)

Focus	Fostering AI to support life-wide skills development across learning settings
Geographical reach	Continental: Sierra Leone and Uganda
Target benefciar ies	Researchers and learners, marginalized rural communities
Monitoring and evaluation	Internal evaluation

What – a description of the initiative

Science Resource Africa (SRA) leverages AI techniques to enhance scientifc research and support the quality of education and scientifc resources available to researchers and learners in Sub-Saharan Africa, including those in rural and displaced communities.

SRA launched a digital innovators (DI) collaborative development programme in 2016 to leverage expertise and develop science and technology-based solutions to educational challenges ranging from electricity to education quality.

Who – initiators, supporters and partners

Science Resource Africa (SRA) is an education non-proft which collaborates with organizations such as the Training and Research for Natural Science Development in Africa (TReND) and the University of Cambridge to promote science education in African communities.

Why – the problem addressed

Education in remote contexts faces a number of challenges beginning with infrastructure constraints such as poor or no access to electricity. Additional challenges such as access to quality of education and gender bias confound ef orts.

How – supporting inclusion

Battery powered phones equipped with AI applications help learners in areas with no or low electricity and Internet connectivity, as well as children who were previously marginalized and/or displaced. The SRA has further linked to the development of various projects including DIY generators, invertors and projectors, and setting up solar energy for schools in rural areas.

The SRA promotes gender diversity through online mentoring schemes which have resulted in an increment of girls' participation in the science fair competition and programmes, including previously male-dominated physics and electronics related felds .

Results – successes and challenges

Various science, ICT, AI and capacity building workshops have been conducted. Participants have worked on various themes and built prototypes of research projects in sectors such as health, education, energy and agriculture. Successful projects include a fuel-free generator used to power community schools; the use of AI and machine learning approaches to studies involving drug discovery and antibacterial resistance; an AI-assisted ETV platform for out-of-school children in Sierra Leone currently being scaled; and AI-assisted platforms for mentoring out of school children in Uganda.

Additional information

http://scienceresourcesafrica.com/

Section conclusions

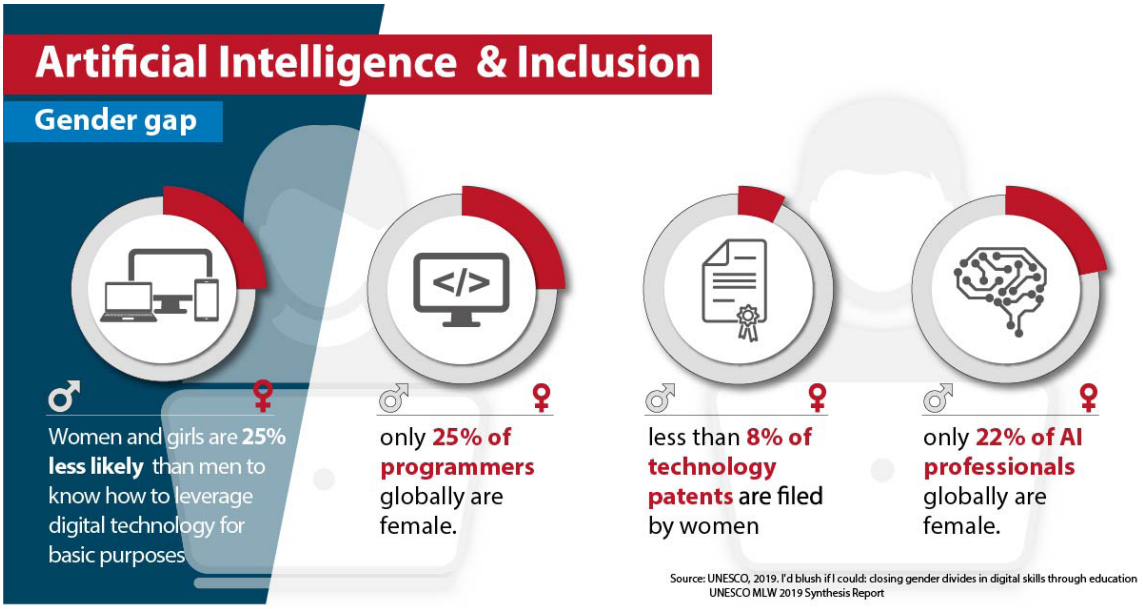
This section has displayed initiatives which respond to prominent challenges faced by the education sector, such as providing access to quality education to remote or displaced populations and the inclusion of persons with disabilities. Initiatives respond to the unique needs of individuals in these groups through the design of products which address both education and context. Context can be accommodated, for example through providing ofine access or designing programs for autonomous learning, or improved, for example through investing in infrastructure to support digital initiatives, fundraising, or creating programmes to provide skills development matched to needs.

Another aspect of enhancing learning outcomes is addressed by focusing the initiatives on teachers. There are projects that aim to address teacher development in general, and those that adopt a more specialized purpose, such as developing the capacity of teachers for educating refugees specifcally , or for providing educators with the opportunity to experiment with the use of digital tools for teaching. Further initiatives include tools that can be used by teachers or education systems, such as online resources for management of distance education in remote areas, psychosocial support systems, virtual classroom learning and the provision of AI education resources.

Initiatives in this section have therefore shown a range of strategies to address the complex issues facing the delivery of quality education across a difcult range of contexts which includes not only developed but also poorly-resourced, remote and displacement contexts. These initiatives provide hope that despite the challenges education can be delivered at scale even to the most vulnerable populations.

SECTION 4: Ensuring non-discriminatory and gender-equitable use of AI for lifelong learning

Section introduction



Artifcial Intelligence has an important role in promoting good practices to combat the existing biases and prejudices. In the words of Daphine Umalusi, a 2019 Africa Code Week participant, "In our modern society, information and knowledge are worldwide one of the most crucial key drivers in social-economic development and their societal infuenc e is constantly growing. This movement makes the problem of information inequality that still exists on many dif erent levels and in various contexts, even more severe." [4]

The initiatives in this section demonstrate support for non-discriminatory and gender-equitable use of AI for lifelong learning as well as AI-empowered pedagogies and strategies to address challenges faced by people on the move. Most of the initiatives in this section operate at a continental or international scale with many target benefciar ies in dif erent age groups, from children as young as 8 to lifelong learners of any age. The programmes that have a strong gender focus seek to introduce and expose women and girls to digital skills, and to ignite an interest in science and technology. Other programmes have a broader focus, but take notice of the intersectionality of inequalities.

Technovation Girls and aspects of Africa Code Week focus specifcally on increasing female participation in the technology feld , while other initiatives provide access to or support lifelong learning for diverse populations. Sophya and TrueLearn use AI to help lifelong learners worldwide connect to relevant content and linked learning pathways. Dawn of Civilization engages individuals in game-based language learning linked to work skills development opportunities,

4 Quote: https://www.newtimes.co.rw/lifestyle/africa-code-week-2019-empowering-young-women-promote-digital-technology

building a foundation for the lifelong learning pathway, which HBMSU engages students in smart learning using AI, enabling increased access to education for diverse populations and building lifelong learning skills.

Particular learning settings addressed in this section also include displaced migrant populations and rural populations in hard-to-reach areas. AI-based interventions include digital tools for crowdfunding, online and app-based learning interventions and teacher training and support tools.

Initiatives such as Kitkit School, Pop-Up Learning and CENTURY Tech demonstrate how AI can be used to support autonomous or self-paced learning, enabling education access even in conditions with no or poor-quality teachers, while the Refugee Educator Academy works to increase the number and knowledge of teachers available to migrants. Yet, the Kolibri Learning Platform include AI-based tools which can be utilized even in low-resource and remote contexts.

Initiative summaries

4.1 AFRICA CODE WEEK

Implementing agency	SAP
Focus	Promoting gender equity in AI use and development
Geographical reach	Continental: 37 African countries
Target benefciar ies	Youth, trainers, women and girls
Monitoring and evaluation	Not available

What – a description of the initiative

Africa Code Week is an annual digital skills development initiative that seeks to empower youth with AI skills, build local trainer capacity and facilitate the adoption of digital and coding curricula. As part of the initiative, #eSkills4Girls boosts education and employment opportunities in the digital century for young women, and the YouthMobile initiative facilitates training in computer science programming and problem-solving, with a focus on increasing female participation.

Who – initiators, supporters and partners

The initiative is led by SAP, a private sector company, and is supported by UNESCO YouthMobile. #eSkills4Girls started under the German G20 presidency with the aim to tackle the existing gender digital divide, in particular in low income and developing countries. More than 130 partner organizations participate.

Why – the problem addressed

Studies such as the UN-led EQUALS report reveal unbalanced gender participation in the digital feld . Only 18% of digital workers on the African continent are female, the lowest percentage internationally. Women entering the technology feld face challenges such as access to hardware and software, lack of information, propagation of gender norms and cultural barriers[5].

How – supporting inclusion

Partner organizations provide free coding workshops for youth, and multi-sectoral support is used to drive policy towards the adoption of coding into national school curricula as a mechanism for addressing skills development, lifelong learning and gender inequities.

#eSkills4Girls provides grants for organizations which teach women and girls in developing countries coding skills, and provides teacher training with a focus on gender-sensitive curriculum development.

Results – successes and challenges

Africa Code Week has reached more than 50,000 teachers and 4 million youth. The #eSkills4Girls initiative has awarded grants to 40 organisations, reaching over 22,000 girls and women. In 2019, 70% of Africa Code Week participants were female.

Additional information

www.AfricaCodeWeek.org

5 https://en.unesco.org/news/empowering-girls-through-coding-unescos-africa-code-week-cooperation

4.2 TECHNOVATION GIRLS AND TECHNOVATION FAMILIES

Implementing agency	Technovation
Focus	Promoting gender equity in AI use and development
Geographical reach	International: Worldwide
Target benefciar ies	Girls aged 10-18; Families with children aged 8-16
Monitoring and evaluation	Internal evaluation

What – a description of the initiative

The Technovation AI Family Challenge and Technovation Girls programmes seek to help girls and families develop greater self-efcac y and change attitudes towards Science, Technology, Engineering and Mathematics (STEM) through mentored engagements using technology to solve real-world problems.

Who – initiators, supporters and partners

Technovation is a global tech education nonproft .

Why – the problem addressed

Low participation of women in the technology sector is an ongoing challenge. Achieving technology's potential to advance the SDGs requires robust programmes that help participants to move beyond a cursory interest in technology.

How – supporting inclusion

With the support of volunteer mentors participants develop new digital skills, form teams, fnd a problem in their communities and develop a technology-based solution. Participants use a visual block-based interface to develop AI-based solutions to local problems ranging from image-recognition software that scans children's drawings for signs of depression to a prototype that detects and removes invasive algae from a lake. The programmes are linked to an annual challenge competition which grants winners the chance to present their mobile app or innovation to a panel of judges at the Technovation Championships.

Results – successes and challenges

Some 130,000 girls, children and parents have created 7,000 mobile apps and AI prototypes, tackling everything from healthcare to climate change. As programme mentors, 14,000 professionals in education, engineering, AI, technology and more have nurtured the love of learning. In 2019, 95% of the 7,500 participants in the AI challenge for families completed the programme.

Additional information

https://www.technovation.org/programs/
https://www.curiositymachine.org/lessons/lesson/

4.3 SOPHYA: THE AI-POWERED 'SPOTIFY' OF LEARNING

Implementing agency	Sophya (startup) / Harvard University
Focus	Using AI to help lifelong learners connect to relevant content
Geographical reach	International: Worldwide
Target benefciar ies	Students leveraging online content
Monitoring and evaluation	Not available

What – a description of the initiative

Sophya is a learning support tool which leverages AI and data science analysis to understand how people use the Internet to learn. Sophya can be used to create personalized learning pathways and provides a series of AI-powered study tools such as spaced repetition fashcar ds and learning analytics, as well as providing recommended learning content from across the worldwide web. Sophya also enables users to curate and organize content, take notes, write on video and share with friends.

Who – initiators, supporters and partners

Sophya is a start-up company supported by various organizations including the Foundation Bertarelli, Harvard University, Google, Disney and Andreessen-Horowitz.

Why – the problem addressed

More now than ever, people rely on the Internet for learning. However, the complexities of online learning require individuals to be aware of both how and what to learn, and individuals may easily be misled among the millions of

search results. Another challenge of online learning is that while learning patterns are repeated among individuals on specifc learning pathways, the data around how learners navigate the 'islands of content' on the Internet to learn best is lost rather than being leveraged to assist others in their learning journeys.

How – supporting inclusion

Sophya relies on crowdsourced behavioural analysis, data science, machine learning and computer vision to assist users in visualizing the pathway between current education level and educational goals. It can be utilized by individuals around the globe for free, requiring only an Internet connection.

Over 20,000 individuals now use Sophya, contributing to learner profles , with the goal to onboard over 200,000 students from worldwide Universities. Over 40,000 pieces of Internet content have been added to the system, which can now be recommended to learners most likely to need them.

Results – successes and challenges

Sophya was developed at Harvard University in the elite incubator Launch Lab X at Harvard Innovation Labs, and was selected as one of eight winners from 1,000 start-ups in Harvard's President's Innovation Challenge 2019. It has been nominated for the UNESCO AI in Education Prize.

Additional information

www.sophya.ai
https://news.harvard.edu/gazette/story/2019/04/fnalists-named-in-har vards-annual-innovation-challenge/
https://www.americaninno.com/boston/boston-startup/this-masschallenge-startup-wants-to-be-the-spotify-of-education/

4.4 TRUELEARN AND X5LEARN: AI-POWERED LEARNING ALGORITHM PROVIDING INCLUSIVE, MULTI-MODAL, CROSS-LINGUAL AND QUALITY LIFELONG LEARNING OPPORTUNITIES FOR ALL

Implementing agency	X5GON project and University College London
Focus	Using AI to help lifelong learners connect to relevant content
Geographical reach	International: France, Germany, North America, Slovenia, United Kingdom
Target benefciar ies	Lifelong learners, including those with disabilities
Monitoring and evaluation	Externally Evaluated *

What – a description of the initiative

TrueLearn is a computer-assisted lifelong-learning recommendation system based on information retrieval and recommendations. It consists of a family of novel recommendation algorithms that are scalable and transparent.

The X5Learn learning platform integrates TrueLearn with a user interface that enables learners to tap into the wealth of OERs available in a manner that is familiar to them.

Who – initiators, supporters and partners

The X5GON project is a multi-national collaboration funded in part by the European Union's Horizon 2020 research and innovation programme. University College London is an X5GON partner.

Why – the problem addressed

Lifelong learning presents unique challenges, such as cultural diversity, disability, background knowledge and the novelty of the material, while ef ectively maintaining a high-quality learning experience across masses of learners for long periods of time, ideally a lifetime.

How – supporting inclusion

TrueLearn is data-efcien t as it does not rely on explicit feedback. The system uses Wikifca tion (e.g. www.wikifer . org) to associate Wikipedia concepts with open educational resources (OERs), creating a highly automatable, domain-agnostic ontology of skills that scale well, since expert labelling of resources is no longer required. The human interpretability of the skills ontology adds transparency to TrueLearn, while supporting learners' metacognition processes such as planning, monitoring and refec tion. TrueLearn uses interaction signals to infer the level of background knowledge of individuals, and is based on Microsoft's TrueSkill skill-based ranking algorithm.

Results – successes and challenges

A real-world lifelong learning dataset of 18,933 learners demonstrates that 80% of positive interactions between learners and OERs are accurately predicted by TrueLearn. Qualitative feedback from a preliminary user study indicated that participants found the system engaging, intuitive to use and helpful for fnding inf ormation in videos.

Additional information

https://www.x5gon.org/wp-content/uploads/2019/10/X5GON_Deliverable_D1_3.pdf
http://www.x5learn.org/
https://www.x5gon.org/
https://platform.x5gon.org/
https://arxiv.org/pdf/1912.01592.pdf

4.5 DAWN OF CIVILIZATION: DELIVERING EDUCATION TO MARGINALISED YOUTH THROUGH GAMING, ARTIFICIAL INTELLIGENCE, AND DATA ANALYSIS

Implementing agency	Solve Education!
Focus	Adopting inclusion as a guiding principle for developing and applying AI for lifelong learning
Geographical reach	International: Cameroon, India, Indonesia, Malaysia, Nigeria, the Philippines, Singapore
Target benefciar ies	Disadvantaged children and out of school youth
Monitoring and evaluation	Not available

What – a description of the initiative

Dawn of Civilization is a game-based learning application linked to real-life opportunities on an online employment platform. The game challenges learners to build a city, taking into account planning, layout, strategies and maximizing tax input to expand. Learners can compete in weekly learning competitions, mini-games linked to prizes. Through the course of the game, learners are able to ef ectively advance their English language ability through the inclusion of more than 30,000 teaching materials linked to game activities.

Who – initiators, supporters and partners

Solve Education! is an education technology nonprofit . In addition to Dawn of Civilization and Solve Employment!, the organization is engaged in YouTube Classifer , which uses YouTube crawlers and artifcial intelligence to identify and level videos which can support language learning.

Why – the problem addressed

Education technology products should be af ordable to those who need them the most, and meet the needs of schools serving the most vulnerable, who may not have teachers, children who can access only low-end devices and children without access to schooling. Disconnects between developers, educators and students result in inef ective delivery of knowledge to students.

How – supporting inclusion

The game is deployed through local communities who work directly with target benefciar ies. The game uses Learnalytics AI to personalize learning experiences based on demonstrated mastery of content and readiness for new materials. Open data sources are also automatically curated to provide content suitable for each learner's profcienc y level. When students reach a working profcienc y level in the game, they are able to explore opportunities on a linked job-seeking platform, Solve Employment! On the Solve Employment! platform, learners can work on micro-tasks developed in partnership with tech companies and improve and refne their sk ills.

Results – successes and challenges

According to the organization's 2018 annual report, at the end of 2018 the organization had engaged a total of 12,194 benefciar ies in 20 countries. Over 80% of learning competition winners were female learners. Over 20% of learners demonstrated improvement in their language capacity.

Additional information

https://solveeducation.org/

4.6 HBMSU (HAMDAN BIN MOHAMMED SMART UNIVERSITY) LIFELONG LEARNING MODEL

Implementing agency	Hamdan Bin Mohammed Smart University
Focus	Adopting inclusion as a guiding principle for developing and applying AI for lifelong learning
Geographical reach	National: United Arab Emirates
Target benefciar ies	Teachers and students
Monitoring and evaluation	Externally evaluated

What – a description of the initiative

Hamdan Bin Mohammed Smart University (HBMSU) lifelong learning model uses AI empowered smart learning to provide opportunities for learners, academics and practising executives to gain useful knowledge while catering to the needs of diverse populations. HBMSU includes a range of technological tools in its of erings including an AI empowered smart campus, chatbots, gamifca tion, a smart portfolio and learning analytics.

Who – initiators, supporters and partners

HBMSU is the frst e-University in the United Arab Emirates. The university provides accredited online learning for students from diverse backgrounds and locations.

Why – the problem addressed

The majority of early research focused on designing autonomous intelligent tutoring systems. However, more recently, there have been AI technologies embedded in non-autonomous systems, used by educators to support a broad range of teaching and learning practices, including learning analytics.

How – supporting inclusion

HBMSU provides higher education and lifelong learning opportunities to students regardless of gender, age and location. On the educational learning platform learners can access educational content, collaborate, take tests and receive real-time results and develop their learning portfolios. AI empowered learning analytics enable faculty members to predict learners' academic success and identify learners who are at risk of failing the course or dropping out of their studies. Faculty are also equipped with skills for providing dif erentiated learning experiences for dif erent ability levels and learning styles.

Results – successes and challenges

HBMSU has emphasized the need for high quality and ef ective online teaching and learning material that is appropriate for dif erent learning styles, preferences and backgrounds. This will enable institutions to leverage advanced technology and pedagogies to deliver quality inclusive higher and further education.

Additional information

https://www.hbmsu.ac.ae/
https://www.hbmsu.ac.ae/about/academics/learning-at-hbmsu
https://youtu.be/tQlawXCD5Xg

4.7 POP-UP LEARNING

Implementing agency	The International Rescue Committee and Imagine Worldwide
Focus	AI-empowered pedagogies and strategies to address challenges faced by people on the move
Geographical reach	International: Bangladesh and Malawi
Target benefciar ies	Children without access to quality education
Monitoring and evaluation	Not available

What – a description of the initiative

Pop-Up Learning is a computer-assisted autonomous learning program that aims to deliver locally relevant literacy and numeracy skills for primary school learners. The system is designed to mobilize quickly and at a low cost per learner in crisis situations, and is adaptable to various contexts, educational levels and languages.

Who – initiators, supporters and partners

Pop Up Learning is a collaboration between the International Rescue Committee (IRC) and Imagine Worldwide. The IRC responds to humanitarian crises by providing relief and essential services. Imagine Worldwide is a non-proft that seeks to scale child-centered, technology-enabled learning for quality educational opportunities.

Pop-Up Learning is used with government schools in Malawi, and with the help of partners Can't Wait to Learn (War Child) and Kitkit School (Enuma) will be testing, adapting and implementing dif erent delivery models in Bangladesh with the Rohingya community.

Why – the problem addressed

Almost 40% of children displaced by humanitarian crises do not have access to formal education, which can help to reduce trauma and stress as well as create lifelong opportunities. Challenges in funding, political landscapes and educator accessibility often mean it can take months or years for displaced children to resume their education.

How – supporting inclusion

The autonomous learning approach leverages low cost, fe xible and mobile technology such as tablets, and can be deployed in homes, centres and schools. Interactive and adaptive learning games ensure children learn at their level. In-person support to guide children through their learning is deployed, though without the need for academic expertise, which can be limited in crisis communities. Open educational resources are leveraged to allow modifca tion and deployment in various contexts.

The low cost per learner and versatility of content and delivery timelines ensure the solution can be rapidly deployed to a wide range of vulnerable populations.

Additional information

https://airbel.rescue.org/projects/pop-up-learning/

4.8 CENTURY AI-POWERED PLATFORM

Implementing agency	CENTURY
Focus	AI-empowered pedagogies and strategies to address challenges faced by people on the move
Geographical reach	International: UK, Lebanon, Middle East
Target benefciar ies	Students
Monitoring and evaluation	Internal evaluation

What – a description of the initiative

CENTURY uses AI technology to provide personalized learning to students, and of ers real-time insights and analytics to educators. In addition to strategies to help students develop skills and retain knowledge, the platform includes messaging to teach students how the brain learns, reinforcing the idea that their ability to succeed is not limited by innate characteristics.

Who – initiators, supporters and partners

CENTURY is a British AI education technology company. CENTURY works with the Lebanese Ministry of Education to run a pilot in Lebanese state schools that host Syrian refugees. The UK Department for International Development supports the initiative.

Why – the problem addressed

Schools across the Middle East are facing an infux of children from refugee backgrounds due to instability in the region. These children face a number of challenges at school, including joining classes mid-year, not having adequate support structures at home and being unable to properly focus on their work.

How – supporting inclusion

Through AI, the CENTURY platform "learns" how every child learns and creates individual learning paths. Its interactive dashboard allows monitoring of student progress in real-time and of ers actionable insights to the teacher, allowing them to target interventions immediately at both school and home. Teacher workload is reduced by automating administration tasks such as marking.

Results – successes and challenges

Refugee students in the Middle East learn on the AI-powered platform at a rate comparable with students in countries like the United Kingdom, suggesting that CENTURY has helped reduce barriers to learning faced by refugee students. Research shows that using CENTURY improves a student's understanding of a topic by 30%.

CENTURY was the overall winner of the 2019 Spectator Economic Disruptor of the Year Awards.

Additional information

https://www.century.tech
https://en.unesco.org/news/century-ai-powered-teaching-and-learning-platform

4.9 CROWDFUNDING TEACHER SALARIES FOR CAMPS FOR REFUGEES AND INTERNALLY DISPLACED PERSONS

Implementing agency	Social Entrepreneurial Consultants PVT Ltd
Focus	AI empowered pedagogies and strategies to address challenges faced by people on the move
Geographical reach	National: Pakistan
Target benefciar ies	Refugees and displaced learners and teachers
Monitoring and evaluation	Not available

What – a description of the initiative

A "frictionless" platform for individual and institutional donations to go directly to teachers in camps for internally displaced persons (IDPs) in Pakistan, which will collect and distribute funding directly to pre-verifed teachers providing education to children in IDP camps.

Who – initiators, supporters and partners

Social Entrepreneurial Consultants (PVT) Ltd is an initiative established to leverage AI to advance inclusion of access to quality learning opportunities for refugees and IDPs.

Why – the problem addressed

Internally displaced persons in tribal districts in Pakistan have limited access to education, and many teachers have left teaching jobs in response to terrorism and moved into camps, where there is insufcien t funding to employ them. Illiteracy rates in IDP camps are signifcan tly increasing, and children aged 5-12 years are severely af ected.

How – supporting inclusion

The platform is aimed at building community using digital technology to facilitate access for refugee children to education, increasing civic engagement, encouraging young people, and providing innovative solutions in the public domain. Digital technology is utilized to establish and build useful apps, and provide a web portal enabling collaboration in support of refugee children. This platform will leverage AI to advance inclusion of access to quality learning opportunities for refugees and IDPs in camps.

Additional information

http://www.secpvtltd.com/ongoing-projects.html

4.10 THE REFUGEE EDUCATOR ACADEMY

Implementing agency	Carey Institute for Global Good
Focus	AI empowered pedagogies and strategies to address challenges faced by people on the move
Geographical reach	International: Middle East, Jordan, Kenya, USA
Target benefciar ies	Teachers
Monitoring and evaluation	Not available

What – a description of the initiative

The Refugee Educator Academy aims to increase the number and preparation of qualifed refugee educators. The initiative consists of an online learning platform with courses, certifca tions, practice communities, and an online support system designed to upskill educators who work with refugee populations.

Who – initiators, supporters and partners

The Carey Institute for Global Good is an American non-proft organization. The Refugee Educator Academy is the fagship programme of the Carey Institute's Center for Learning in Practice, a platform providing online learning opportunities.

Why – the problem addressed

With more than 65 million forcibly displaced people in the world, it is necessary to increase the number of teachers skilled in the context of 'people on the move'.

How – supporting inclusion

The Refugee Educator Academy makes existing content available in measured, digestible chunks which educators can use in their unique contexts. Facilitated and self-study courses are supported in a fe xible framework.

Sustainable Learning Loops keep the learning environment viable and adaptive. New algorithms are applied to enhance the speed, scale, depth, distance, and complexity of work presented, leveraging opportunities for amplifca tion and enhancement of the framework that are created by working online.

Additional information

https://careyinstitute.org/programs/education/refugee-educator-academy/
https://learning.careyinstitute.org
https://www.learninginpractice.org

4.11 THE KOLIBRI LEARNING PLATFORM: DATA AND MODEL TRAINING FOR OFFLINE INCLUSIVE AI

Implementing agency	Learning Equality
Focus	Orientating the use of AI to enhance learning outcomes of disadvantaged groups
Geographical reach	International: Worldwide access
Target benefciar ies	Learners and educators
Monitoring and evaluation	Not available

What – a description of the initiative

The Kolibri learning platform brings curriculum aligned open educational content to ofine learners and allows teachers to monitor student progress that can be used in places with no, or limited, Internet connectivity. The platform contains digital materials and information such as lesson plans, assessment tools, books and games. Kolibri assigns dif erentiated materials and exercises to groups or individual learners, and includes a dashboard which alerts educators when individual learners need additional support. Instructors and organizations can also create locally relevant, customized educational curricula that ft their c ontext.

Who – initiators, supporters and partners

Learning Equality is a non-proft educational organisation which supports the right to quality education, innovative pedagogies and open educational resources.

Why – the problem addressed

The "online learning revolution" has the potential for broad, free access to educational resources. One of the greatest barriers is that an estimated 4.5 billion people still lack Internet access. Countries with the least Internet access are in general the same countries with the least access to quality education, including fewer qualifed teachers per student and fewer educational materials.

How – supporting inclusion

The platform takes advantage of existing infrastructure and low-cost as well as low-power hardware solutions to distribute and host open educational resources via low-bandwidth and ofine channels .

Using metadata, Kolibri has the potential to recommend additional learning materials, and high-level, anonymized, aggregate data can be collected and analysed even with intermittent connectivity, creating a more comprehensive and inclusive dataset that can be used for training more sophisticated predictive models.

Results – successes and challenges

The initiative blends technology with varying hardware set-ups in very large classes with high student-to-teacher ratios, as well as deliver for non-formal learning environments and low-resource contexts. Training topics include models of blended learning, integrating technology and lesson planning with open educational resources. The initiative has highlighted a need for locally-created content.

Additional information

https://learningequality.org/kolibri
https://blog.learningequality.org/stepwithrefugees-33e0c17f9643

4.12 KITKIT SCHOOL SUPPORTS VULNERABLE LEARNERS' LANGUAGE NEEDS

Implementing agency	Enuma
Focus	AI-empowered pedagogies and strategies to address challenges faced by people on the move
Geographical reach	National: Bangladesh
Target benefciar ies	Rohingya refugee children
Monitoring and evaluation	Externally evaluated

What – a description of the initiative

The Kitkit school is an at-home tablet-based learning program used to support Rohingya refugees in Bangladesh. This innovative and scalable model provides a literacy and maths program that covers early childhood to second grade skills as part of a coordinated early response to this emergency.

Who – initiators, supporters and partners

Enuma is an education technology company with ofc es in Berkeley and Seoul. This use of Kitkit school is undertaken in partnership with the International Rescue Committee and Imagine Worldwide.

Why – the problem addressed

The majority of Rohingya children who have fed from violence in Myanmar to Cox's Bazar, a district in Bangladesh, do not have access to learning opportunities, and where they do, they experience crowded classrooms with mixed learning levels and few qualifed t eachers.

How – supporting inclusion

The Kitkit Learning App is a suite of interactive educational activities promoting foundational literacy and math skills. Utilizing the tablet's touch-based interface, the current version of Kitkit School includes 12 learning courses covering early childhood literacy and math with over 600 mini-game activities.

In order to make the programme more accessible and relevant to Rohingya-speaking children, the team developed English-language content and supports for children who

speak an unscripted native language. A modifed set of tools manage hundreds of children in "pop-up" home and centre-based sites. This approach has the potential to ensure that vulnerable and displaced children do not miss out on learning tailored to their specifc needs .

Results – successes and challenges

Enuma's Kitkit School was co-winner of the Global Learning XPRIZE competition in 2019.

Additional information

https://enuma.com/
https://www.imagineworldwide.org/our-work/bangladesh/
http://kitkitschool.com/

Section conclusions

The progressive ef orts by the various stakeholders in seeking to address existing inequalities and ensure non-discriminatory and gender-equitable use of AI aim to achieve inclusion in digital skills and technology in dif erent ways, such as providing mentorship; training in coding, AI and problem-solving; and AI-driven lifelong learning platforms. Initiatives primarily aim to increase access and participation by women and supporting lifelong learning pathways more broadly, and have broad target audiences and scope.

Most of the initiatives in this section are well established and have been in operation for an extended period. Some initiatives have a global or continental reach, and international cooperation can be observed in some, which leverage global or continental cross-sectoral expertise to skill and empower women and other groups. In particular, initiatives focused on women and children outline the need for targeting and tailoring of initiatives to this demographic, in one case noting the need for a prolonged engagement strategy to develop a robust interest in technology.

Initiatives in this section have shown some of the ways in which access to AI technology can bridge gender gaps, as well as ways in which AI can promote and contribute to lifelong learning across contexts.

Concluding comments

Through a focus on equity and inclusion, the AI initiatives presented in this compendium all seek to close various digital divides and contribute to universal access to quality lifelong education, making sure that no one is excluded.

This compendium highlights many promising efforts being put forward towards using AI to overcome some of education's most pressing challenges. In line with the theme of AI and Inclusion, the initiatives submitted for MLW2020 focus prominently on underserved populations such as displaced persons, rural and minority demographics, linguistic minority groups and persons with disabilities. By the targeted use of AI towards vulnerable populations, these initiatives are contributing to a reality in which AI is used to address education gaps between communities, providing opportunities for disadvantaged populations to not only catch up with more advantaged peer groups but also at times integrate into systems they would not otherwise have full access to, such as work experience opportunities, national and international competitions and AI training, lifelong learning pathways and education administration and support systems.

The initiatives show that a range of stakeholders have invested in inclusive AI for education, including private companies, local and international non-profit organizations, academia, government institutions and multi-stakeholder partnerships. AI initiatives are undertaken through various strategies, such as the development of knowledge products, initiatives to train individuals across the spectrum of lifelong learning on AI and AI development, applications of AI to directly provide education in challenging contexts and to underserved populations, and the provision of open learning opportunities and resources to increase access, reduce inequality and promote lifelong learning.

Initiatives also demonstrate an important shift in attitudes of AI developers towards teachers as well. AI is now being more widely used for teacher training as well as integrated into curriculum delivery in non-emergency settings. This shows that AI in education practitioners and governments are harnessing the power of AI and ICTs to provide experiential learning for teachers, an important step towards meaningful classroom use of technology. The initiatives also give evidence that education stakeholders are thinking meaningfully about the roles of teachers and learners in the era of AI, with many initiatives focused on providing teaching tools to augment rather than replace traditional face-to-face learning models.

Finally, the compendium highlights a key benefit of the AI era, which is that international collaboration efforts can be launched from anywhere and still result in worldwide participation in both the creation and use of AI tools and related programmes and training efforts. This compendium has highlighted both international and diverse national efforts towards improving the worldwide digital ecosystem which can be taken up and applied across contexts.

Areas of further interest

An emerging focus in this compendium demonstrates some examples of how AI can function not only to provide learning solutions to address educational and social disparities, but also at times to bridge these gaps between communities and demographics. Initiatives are beginning to consider how AI can also support the integration of disadvantaged groups into education and its related opportunities. Examples include methods of supporting persons with disabilities through formal education pathways, provision of language learning and language preservation tools to minority groups, and exchanges between previously disconnected resources such as disadvantaged students and AI industry expertise or mentors. A future direction for AI and technology more broadly will be to consider more effective ways in which AI can be used to bridge not only learning outcome gaps but social, political and economic divides within and between countries.

Additionally, initiatives included in the compendium are at various stages of development, with some still emerging and others well established. However, one trend across initiatives shows that while research and data collection are well-established, an increased emphasis on evaluation of AI in the education sector would be benefcial to supporting AI's further development and could increase the responsiveness and replicability of interventions.

Last, while research and international discussions focus on a wide range of gender-related topics, the initiatives implemented to date primarily focus on increasing female participation in the AI sector, provide training for specifc outcomes such as literacy to a female target group, or work more broadly on access to quality education through AI. While increasing female participation in the range of digital landscapes is part of the solution, there is still a need for international cooperation and targeted intervention to mitigate other ways in which AI can be harmful to women and non-binary gender populations, such as eliminating the perpetuation or creation of stereotypes, identifying and rectifying bias in decision-making algorithms, strengthening education around reproduction and gender, and targeting gender-based digital harassment. One prominent role international organisations working in education can seek to fll is to provide platforms and coordination which centres gender equality in development conversations.

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