Artificial Intelligence Education from the Perspective of United Nations Documentation: Realising Global Sustainable Development Goals

Xiaoxu Jia* and Zhaoning Zhang**

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Abstract

Under the "2030 Agenda for Sustainable Development", education has been established as Sustainable Development Goal 4 (SDG4), but the reality of global education continues to face severe challenges. With the rapid advancement of AI, it has become a crucial tool to enhance the effectiveness of education. By analysing the influence of AI in education, including personalised learning, data-driven precision teaching, and automated assessment, this paper further explores the relationship between AI and sustainable development as described in the publicly released documents by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). Ultimately, it proposes a series of strategies to promote the realisation of global sustainable development through AI education, including nurturing global citizens with AI thinking and sustainable

* Associate Professor, Research Institute for Ideological and Political Education, Harbin Institute of Technology University, 92 West Dazhi Street, Harbin City, Heilongjiang Province 150001, China.
E-mail: jiaxx@hit.edu.cn

** Research Institute for Ideological and Political Education, Harbin Institute of Technology University, 92 West Dazhi Street, Harbin City, Heilongjiang Province 150001, China.
E-mail: zzn_lynn@163.com

development literacy, narrowing the digital divide, constructing an equitable and quality AI education ecosystem, and incorporating ethical principles of sustainable development into AI education. The final conclusion is that AI education plays a pivotal role in advancing global sustainable development goals and that there should be a comprehensive enhancement of its importance, with strengthened technological support and ethical norm construction, to make a positive contribution to global sustainable development goals.

Keywords: United Nations Educational, Scientific and Cultural Organization, Artificial Intelligence, Sustainable Development

การศึกษาปัญญาประดิษฐ์จากมุมมองในเอกสารขององค์การสหประชาชาติ : ตระหนักรู้การพัฒนาโลกที่ยั่งยืน

เซียวซู่ เจีย* และ เจ้าหนิง จาง**

รับวันที่ 13 กรกฎาคม 2566 *ส่งแก้ไขวันที่ 23 มีนาคม 2568* *ตอบรับตีพิมพ์วันที่ 10 เมษายน 2568*

บทคัดย่อ

แผนการพัฒนาที่ยั่งยืน ค.ศ. 2030 กำหนดให้การศึกษาเป็นเป้าหมายการพัฒนาที่ยั่งยืนที่ 4 (SDG4) หากแต่ในความเป็นจริงนั้น การศึกษาของโลกยังคงเผชิญกับความท้าทายหลากหลาย ทั้งนี้ความก้าวหน้าอย่างรวดเร็วของปัญญาประดิษฐ์ได้กลายเป็นเครื่องมือ สำคัญในการเพิ่มประสิทธิภาพของการศึกษา มีการวิเคราะห์อิทธิพลของปัญญาประดิษฐ์ในด้านการศึกษา รวมทั้งการเรียนรู้เฉพาะ บุคคล การสอนที่ใช้ข้อมูลที่มีความแม่นยำ ประกอบกับการวัดการเรียนการสอนโดยวิธีอัตโนมัติ งานวิจัยนี้ศึกษาความสัมพันธ์ระหว่าง ปัญญาประดิษฐ์และการพัฒนาที่ยั่งยืน ดังที่ได้มีการอธิบายไว้ในเอกสารตีพิมพ์ขององค์การการศึกษาวิทยาศาสตร์และวัฒนธรรมแห่ง สหประชาชาติ (ยูเนสโก) โดยนำเสนอชุดกลยุทธ์เพื่อส่งเสริมการตระหนักรู้เรื่องการพัฒนาที่ยั่งยืนของโลกผ่านการศึกษาปัญญาประดิษฐ์ที่บ่มเพาะประชาการโลกให้คิดแบบปัญญาประดิษฐ์และรู้ถึงการพัฒนาที่ยั่งยืน อันจะส่งผลให้โลกดิจิตัลแคบลง พร้อมไปกับการสร้างความเท่าเทียมของระบบนิเวศการศึกษาปัญญาประดิษฐ์ อีกทั้งผนวกหลักการด้านจริยธรรมการพัฒนาที่ยั่งยืนไว้ใน การศึกษาปัญญาประดิษฐ์ ผลการวิจัยแสดงให้เห็นว่า การศึกษาปัญญาประดิษฐ์มีบทบาทสำคัญในการพัฒนาเป้าหมายการพัฒนา ที่ยั่งยืนของโลก ทั้งนี้ควรมีการปรับปรุงความเข้าใจด้านความสำคัญของปัญญาประดิษฐ์ให้มีความครอบคลุมด้วยการสนับสนุน ด้านเทคโนโลยีประกอบกับการสร้างบรรทัดฐานด้านจริยธรรม ทั้งนี้เพื่อให้เกิดผลลัพธ์ ทางบวกแก่เป้าหมายการพัฒนาที่ยั่งยืน ของโลกต่อไป

คำสำคัญ: องค์การการศึกษาวิทยาศาสตร์และวัฒนธรรมแห่งสหประชาชาติ, ปัญญาประดิษฐ์, การพัฒนาที่ยั่งยืน

* รองศาสตราจารย์ สถาบันวิจัยการศึกษาอุดมการณ์และการเมือง มหาวิทยาลัยเทคโนโลยีฮาร์บิน
92 ถนนต้าจื้อใต้, เมืองฮาร์บิน, มณฑลเฮยหลงเจียง 150001, ประเทศจีน.
อีเมล์: jiaxx@hit.edu.cn

** สถาบันวิจัยการศึกษาอุดมการณ์และการเมือง มหาวิทยาลัยเทคโนโลยีฮาร์บิน
92 ถนนต้าจื้อใต้, เมืองฮาร์บิน, มณฑลเฮยหลงเจียง 150001, ประเทศจีน
อีเมล์: zzn_lynn@163.com

Introduction

Research Background

In 2015, the United Nations adopted the "2030 Agenda for Sustainable Development", establishing 17 Global Goals for Sustainable Development. Among them, education was recognized as a fundamental human right, giving rise to the vision of "providing inclusive and equitable quality education and promoting lifelong learning opportunities for all", namely Sustainable Development Goal 4 (SDG4). This goal is not only seen as an independent sustainable development goal but also holds significant value in empowering other goals. However, in reality, global education is still facing severe challenges, especially the severe impact on various forms of education brought about by major sudden public health events such as the COVID-19 pandemic. With the rapid development of AI and its widespread application in various social fields, how to promote AI to empower and enhance education has become a key issue for achieving global sustainable development. Based on declarations, reports, guidelines, and other public documents published by UNESCO in the past decade, this paper explains and analyzes the new trends in the development and transformation of AI in education presented therein, with the aim of providing new ideas for the bidirectional integration of AI technology and pedagogy.

Research Design

This study aims to delve into the role of AI in education in achieving global sustainable development goals, particularly the attainment of SDG4 (Education Goal). To achieve this objective, the study adopts a methodology combining literature review and case analysis.

1. Literature Review

By consulting the UNESCO official website, databases, academic journals, and conference papers, we have collected a vast amount of literature on AI in education, sustainable development goals, and their interrelationships. These documents encompass policy papers, research reports, academic papers, and various other forms, providing a solid theoretical foundation and empirical evidence for this study.

2. Case Analysis

To more specifically demonstrate the effectiveness and challenges of AI in education in practical applications, this study also selects typical cases from several countries or regions for in-depth analysis. These cases cover countries or regions with different levels of development, cultural backgrounds, and educational systems, aiming to reveal the commonalities and differences of AI in education across various contexts.

3. Data Analysis

Based on the collected data, this study adopts a combined qualitative and quantitative data analysis approach. Qualitative analysis is primarily used to interpret the core viewpoints and recommendations in the policy documents, reports, and guidelines published by UNESCO. Through in-depth interpretation of these texts, we extract the key roles and potential challenges of AI in education in achieving global sustainable development goals. Quantitative analysis, on the other hand, is mainly based on data provided by the UNESCO Institute for Statistics, conducting a quantitative analysis of various indicators related to SDG4. We extract data on SDG4-related indicators from 2015 to 2021 and present the trends of these indicators through charts, providing a visual representation of the current status and challenges faced by global education development.

Analytical Methods

This paper primarily adopts content analysis, trend analysis, and case study methods, while adhering to a critical research perspective. Through a critical lens, we can identify potential biases, injustices, and exploitation in the process of technological development. Subsequently, how to overcome these obstacles through policy adjustments, social movements, or individual actions can be explored.

1. Content Analysis Method

Content analysis is the main qualitative analysis method employed in this study. Through in-depth reading and analysis of policy documents, reports, and guidelines published by UNESCO, we extract core viewpoints and recommendations related to AI in education and sustainable development goals. On this basis, we classify, summarize, and compare these viewpoints and recommendations to reveal their intrinsic connections and logical relationships.

2. Trend Analysis Method

Trend analysis is the primary quantitative analysis method used in this study. By conducting trend analysis on data provided by the UNESCO Institute for Statistics (UIS), we reveal the trends and underlying patterns of various indicators related to SDG4. Specifically, we employ time series analysis, regression analysis, and other methods to deeply explore and interpret the data, thereby revealing the current status and trends of global education development.

In summary, this study systematically explored the role and challenges of AI in education in achieving global sustainable development goals through a combination of literature review, qualitative analysis, quantitative analysis, and other methods. With a scientific research design and rigorous data analysis, we provide valuable references and insights for the future development of AI in education.

"2030 Agenda for Sustainable Development" and SDG4

The 2030 Agenda for Sustainable Development (*hereinafter referred to as the "2030 Agenda"*) is a global agreement jointly reached by all Member States of the United Nations in 2015. The Agenda sets out 17 Sustainable Development Goals (SDGs), 169 targets, and 231 indicators, providing to some extent a guiding framework and direction for the development governance transformation of countries around the world in the contemporary era. The "2030 Agenda" underscores a fundamental human rights stance, unambiguously employing seminal documents such as the "Universal Declaration of Human Rights", various international human rights treaties, and the "Declaration on the Right to Development" as its action guide. The core purpose of this agenda is "to ensure the human rights of all" (excerpted from the preamble of the "2030 Agenda"), asserting that this purpose applies universally to all individuals, regardless of the size of the nation, or whether it's a developed or developing country. Among these, the fourth indicator (SDG4) is the "Education Goal", aimed at "ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all".

The Establishment and Targets of SDG4

Specifically, SDG4 comprises 10 targets, including 7 expected outcome targets (4.1-4.7) and 3 means of implementation targets (4.a-4.c). They are: ***4.1 Universal Primary and Secondary Education***. By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes. ***4.2 Early Childhood Development and Universal Pre-Primary Education.*** By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education. ***4.3 Equal Access to Technical/Vocational and Higher Education.*** By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university. ***4.4 Relevant Skills for Decent Work.*** By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship. ***4.5 Gender Equality and Inclsion.*** By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations. ***4.6 Universal Youth Literacy.*** By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy. ***4.7 Education for Sustainable Development and Global Citizenship.*** By 2030, ensure that all students acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development. ***4.a Effective Learning Environments.*** Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all. ***4.b Scholarships.*** By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programs, in developed countries and other developing countries. ***4.c Teachers and Educators.*** By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States.

The Impact of SDG4 on Global Educational Development and Its Challenges

It's fair to acknowledge that many governments have incorporated the Sustainable Development Goals into the apex design of national development, establishing corresponding policy frameworks, budget plans, cross-departmental collaboration platforms, and assessment monitoring mechanisms (OECD, 2017). Simultaneously, due to the lack of organizational consistency, effective data monitoring and evaluation systems, sufficient funding, and disparities in national priority development areas, many scholars have begun to question the feasibility of achieving SDG4 by 2030. Especially in low-income countries in Asia, Africa, and Latin America, some indicators remain stagnant or even regressive (Saxena et al., 2022; Ajulor, 2018).

To illustrate, the most recent data from UNESCO Institute for Statistics illuminates a minor stagnation and regression in the three indicators within *Target 4.2.2: "Adjusted net enrolment rate, one year before the official primary entry age, for both sexes", "Adjusted net enrolment rate, one year before the official primary entry age, for females",* and *"Adjusted net enrolment rate, one year before the official primary entry age, for males",* which stood at 74.63%, 74.73%, and 74.53% respectively in 2021.

Similarly, a faint halt and backward trend became evident in several indicators encapsulated within *4.c.1* of Method *4.c,* such as *"Proportion of teachers with the minimum required qualifications in lower secondary education, both sexes",* "Proportion of teachers with the minimum required qualifications in primary education, both sexes", *"Proportion of teachers with the minimum required qualifications in secondary education, both sexes",* and *"Proportion of teachers with the minimum required qualifications in upper secondary education, both sexes"*, which recorded rates of 83.80%, 86.16%, 84.36%, and 85.05% respectively in 2020 compared to earlier data.

Several indicators within Targets ***4.c.3*** and ***4.c.4***, including *"Percentage of qualified teachers in secondary education, both sexes", "Percentage of qualified teachers in upper secondary education, both sexes", "Pupil-qualified teacher ratio in lower secondary education", "Pupil-qualified teacher ratio in pre-primary education"* and *"Pupil-qualified teacher ratio in primary education"* also disclosed a slight retrograde trend in their 2020 data. See Table 1 for detailed data.

Table 1: Indicators in SDG4 that are in a Stagnant or Regressive Trend. (Region : World)

Target	Indicators	2015	2016	2017	2018	2019	2020	2021
4.1.0	Proportion of children/young people at the age of primary education prepared for the future in mathematics, both sexes (%)	38.39	38.36	38.28	38.25	38.21		
4.1.1	Proportion of students at the end of primary education achieving at least a minimum proficiency level in mathematics, both sexes (%)	45.22	44.97	44.72	44.47	44.22		
4.1.2	Proportion of students at the end of primary education achieving at least a minimum proficiency level in reading, both sexes (%)	58.75	58.59	58.42	58.26	58.09		
4.2.2	Adjusted net enrolment rate, one year before the official primary entry age, both sexes (%)	75.01	74.63	74.46	74.39	74.55	74.63	
4.2.2	Adjusted net enrolment rate, one year before the official primary entry age, female (%)	74.80	74.57	74.38	74.48	74.63	74.73	
4.2.2	Adjusted net enrolment rate, one year before the official primary entry age, male (%)	75.19	74.67	74.53	74.30	74.46	74.53	
4.5.1	Gross enrolment ratio for tertiary education, adjusted gender parity index (GPIA)	1.10	1.11	1.12	1.12	1.13	1.14	
4.5.1	Proportion of 15-24 year-olds enrolled in vocational education, adjusted gender parity index (GPIA)	0.80	0.81	0.80	0.87	0.86	0.80	
4.5.1	Proportion of pupils enrolled in lower secondary general education who are at least 2 years over-age for their current grade, adjusted gender parity index (GPIA)	0.76	0.76	0.77	0.82	0.79	0.76	

Table 1: Indicators in SDG4 that are in a Stagnant or Regressive Trend. (Region : World) (Continued)

Target	Indicators	2015	2016	2017	2018	2019	2020	2021
4.5.1	Proportion of pupils enroled in primary education who are at least 2 years over-age for their current grade, adjusted gender parity	1.00	1.08	1.16	1.16	1.14	1.17	
4.5.1	Proportion of qualified teachers in pre-primary education, adjusted gender parity index (GPIA)	1.03	1.01	1.02	1.04	1.05	1.05	
4.c.1	Proportion of teachers with the minimum required qualifications in lower secondary education, both sexes (%)		84.01	84.37	83.60	83.81	83.80	
4.c.1	Proportion of teachers with the minimum required qualifications in primary education, both sexes (%)	85.80	84.05	85.18	86.57	86.18	86.16	
4.c.1	Proportion of teachers with the minimum required qualifications in secondary education, both sexes (%)		85.78	86.02	87.01	84.31	84.36	
4.c.1	Proportion of teachers with the minimum required qualifications in upper secondary education, both sexes (%)		88.06	88.15	91.42	84.93	85.05	
4.c.3	Percentage of qualified teachers in secondary education, both sexes (%)	92.62	92.51	91.16	93.58	94.22	91.62	
4.c.3	Percentage of qualified teachers in upper secondary education, both sexes (%)	88.12	90.69	87.79	88.15	86.47	86.51	
4.c.4	Pupil-qualified teacher ratio in lower secondary (headcount basis)	18.60	18.50	17.97	17.91	17.84	17.90	
4.c.4	Pupil-qualified teacher ratio in pre-primary education (headcount basis)	24.62	22.44	22.32	22.18	21.94	21.39	
4.c.4	Pupil-qualified teacher ratio in primary education (headcount basis)	25.37	25.86	25.79	24.96	24.90	24.79	

Note: From UNESCO. (n.d.). UIS Data Portal. http://sdg4-data.uis.unesco.org/.

From this, it can be observed that SDG4 has played a significant role in propelling global educational development. However, issues such as the quality of education, equity in education, and teacher qualifications present formidable challenges for its realization by 2030. With the rapid development of next-generation information technology, educational technology is progressing towards more information-oriented, networked, and intelligent directions. Particularly, the gradual popularization of AI will present new opportunities for education.

The Impact of Artificial Intelligence on Education

AI, as a cutting-edge interdisciplinary field, is generally seen as a new technological science that studies, develops, and applies theories, methods, techniques, and application systems to simulate, extend, and expand human intelligence. In recent years, thanks to the rapid development of three core elements: Algorithms, Data, and Computing Power, AI has experienced its third wave of development since its inception, and it has become the focus of future international competition and the new engine of economic development, attracting widespread attention. Many governments have introduced relevant policies from the perspective of national strategy to encourage the development and innovation of the industry, focusing on the research and development of AI's underlying technology, while also exploring the fusion path of *"AI+"*, such as the application of the large language model[1] ChatGPT in various aspects of education. Currently, AI is recognized as providing technical support for personalized learning, resource allocation and utilization in teaching, data-driven decision-making, and automated assessment in education.

Positive Impact

Personalized learning, data-driven precise teaching and research, and automated assessment constitute the important application landscape of AI in education. Personalized learning makes education more tailored to the unique needs of each student, enhancing learning efficiency and motivation. Data-driven precise teaching and research provide teachers

[1] Large Language Model is a complex AI system built on deep learning technology, with the core function of understanding and generating human language.

with scientific bases for teaching improvement, making teaching strategies more precise and effective. Automated assessment reduces teachers' workload and improves the accuracy and comprehensiveness of assessments. Meanwhile, AI in psychological and health assessment provides strong support for the comprehensive development of students. These applications not only demonstrate the enormous potential of AI in education but also point out the direction for the future development of education.

1. Personalized Learning

Personalized learning refers to AI creating exclusive learning paths for each student by dynamically analyzing their learning behavior, interests, and knowledge structure. AI can track learning progress in real time, recommend learning resources that match the difficulty level, predict knowledge gaps through algorithms, and proactively push targeted exercises. For example, AI can adjust review plans based on the types of mistakes made or simulate “one-on-one” conversation scenarios to improve language proficiency, making learning more efficient and tailored to individual needs.

In traditional teaching modes, students within the same educational environment often follow a unified teaching pace and content, which is frequently criticized as a “one-size-fits-all” approach that fails to meet the unique learning needs of each student. As a result, the implementation of the educational philosophy of “teaching students according to their aptitude” often encounters practical difficulties. However, personalized learning based on AI can adapt to students' learning habits, abilities, and progress, providing a more effective and targeted learning experience.

Taking adaptive learning platforms as an example, these platforms utilize machine learning algorithms to collect and analyze students' data, such as learning speed, academic performance, types of errors made and online learning behavior, etc. This data can depict students' learning progress, level of knowledge mastery, and understanding of specific topics. Based on this information, the system adjusts the difficulty and pace of learning materials to ensure that each learner can study in an environment suitable for their own level and rhythm. Byju's personalized learning system in India is a great example. It deeply empowers

personalized learning through an algorithmic recommendation mechanism, and its core logic is as follows: the system first collects students' learning behavior data and multi-dimensional evaluation results to build a refined user profile; subsequently, machine learning algorithms dynamically calculate students' ability boundaries and learning needs based on educational psychology models and knowledge graphs, and intelligently match differentiated teaching resources. At the same time, the system also monitors the learning process in real time, dynamically adjusts the difficulty curve through adaptive testing, so that each learner can obtain a customized learning plan that accurately adapts to their cognitive rhythm and development potential.

With the help of this approach, AI can provide a personalized learning path for each learner, thereby improving their learning efficiency and enhancing their learning motivation and engagement. However, this does not mean that AI can completely replace the role of teachers. Teachers still play an irreplaceable and crucial role in guiding students' learning, providing feedback, encouraging critical thinking, and cultivating social and emotional skills.

2. Data-Driven Precise Teaching and Research

Data-driven precise teaching and research refers to AI providing scientific decision-making support for teaching and research based on the collection and analysis of data throughout the entire teaching process. By integrating multi-source data such as classroom interactions, homework completion, and exam evaluations, AI can generate academic portraits. With the accurate portraits, AI can accurately locate teaching difficulties, automatically correlate knowledge points with teaching effectiveness, provide a basis for teachers to optimize lesson plan design, and even uncover the relationship between teaching styles and student performance. It realizes the transformation from “experience-driven” to “data-driven” teaching and research. Leveraging big data and machine learning technologies, AI can collect, process, and analyze massive amounts of historical data, providing educators with an additional perspective to observe and understand students' learning behaviors, preferences, and difficulties. It helps teachers to design and improve teaching strategies more effectively.

AI can collect various types of data, including students' homework scores, exam results, online learning behaviors, and teachers' teaching behaviors. By recognizing and analyzing this data, AI assists teachers in better understanding the relationships between teaching content, methods, and effectiveness, as well as potential areas for future improvement. At the same time, teachers can provide more targeted teaching support based on students' needs.

Currently, artificial intelligence analyzes and integrates the teaching resources selected and inputted by teachers, and finally generates concrete forms about the course. This not only facilitates teachers' management and sharing of teaching resources but also promotes students' learning and mastery of these resources. Taking the "XuetangX" platform, founded and operated by Tsinghua University in 2013, as an example, the platform has a function that can generate a knowledge graph[2] for a course with one click, which heavily relies on the involvement of AI. The application of this technology can be divided into three phases: knowledge supply, knowledge training, and knowledge application. In the first phase, teachers are mainly responsible for screening and inputting teaching resources. They collect, organize, and input resources such as MOOCs, textbooks, and videos, preparing for the analysis, integration, and recommendation of teaching resources in the next phase. Next, through AI and the efforts of a knowledge team, the teaching resources are analyzed and processed to construct a knowledge graph for the course. It is worth noting that in the second phase, teachers are still need to oversee and guide the processing content to ensure the smooth progress of the teaching process, and gradually improving its accuracy and scientificity. With the construction and formation of knowledge graphs, the form of courses can be further expanded, students can continuously enrich and consolidate teaching content. And teachers can more accurately grasp the individual and group learning level of students based on the learning data generated by them, thereby improving teaching quality and achieving more agile teaching according to individual needs.

[2] Knowledge Graph is a technology that presents human knowledge in a structured network format and connects fragmented information into an inferable semantic network.

3. Automated Assessment

Automated assessment refers to the automation of teaching evaluation processes such as homework grading, oral evaluation, and experimental operations through natural language processing and image recognition technologies. This system can not only provide second-level feedback on objective question answers but also understand the logic of subjective questions and provide scoring suggestions. By analyzing learning process data, it can generate multi-dimensional ability reports. It can even evaluate learning engagement and emotional states by combining facial expressions and voice intonation, providing teachers with in-depth insights into learning situations beyond traditional scores, and greatly improving evaluation efficiency and accuracy.

In the modern education environment, automated assessment has gradually become an effective and promising tool to solve challenges such as time, effort, and accuracy faced by manual grading. AI in this process far exceeds academia's previous understanding of teaching aids. It can not only generate test questions automatically but also accurately correct non-open-ended test questions according to standard answers and give approval opinions on open-ended test questions. For example, the GPT-4-powered scientific manuscript pre-review tool developed by Stanford University is an innovative application of AI in academic publishing. Its core value lies in simulating human review thinking through algorithmic models, compressing the traditional peer review process, which takes weeks, into a minute-level response, significantly improving the timeliness of academic feedback. This automated evaluation not only covers basic dimensions such as paper structure and logical coherence but also identifies deep evaluation elements such as alignment with disciplinary frontiers and methodological innovation based on large-scale journal data, providing researchers with diverse perspectives that go beyond the limitations of a single reviewer's experience. Although AI still faces challenges in understanding open-ended questions, by treating it as a data training problem, deep learning methods based on neural networks can be used to classify answers according to the core features of students' responses and subsequently develop assessment models.

The capabilities of AI go far beyond this. By accurately collecting and analyzing students' psychological and health data, AI can become a personal tutor and health doctor to assess and improve their physical and mental qualities. For example, by establishing a multi-dimensional psychological quality assessment model, AI can help teachers identify psychological problems of students and intervene in a timely manner. In terms of physical health, intelligent devices can collect students' behavior data to understand their physical health, identify deficiencies in lifestyle habits, sports skills, health knowledge, etc., and actively warn and intervene.

Another important role of AI is to serve as the "Head Teacher" that generates comprehensive quality evaluation reports. For example, using the "Smart Learning Companion" learning platform, a large amount of learning process data can be collected and analyzed to generate a comprehensive quality evaluation report that includes knowledge, ability, and non-intelligence factors. This report is not just a simple score or level, but a detailed report with multiple parameters, which visually shows the learner's subject literacy level, subject ability level, behavior status, etc.

Negative Impact

When exploring the widespread application of AI in education, we must confront the numerous limitations faced by countries worldwide in advancing this process. These limitations not only pertain to technical challenges but also encompass multiple dimensions such as infrastructure, culture, and social ethics, collectively forming a complex landscape for the comprehensive promotion of AI in education.

The application of AI in the education sector may also have complex implications for educational equity. On the one hand, the popularization of AI holds promise for breaking down geographical and economic barriers to educational resources, providing students with equal learning opportunities. Through personalized learning and intelligent assessment, AI can offer customized learning resources and teaching plans tailored to students' learning needs and progress, thereby enhancing learning outcomes and educational quality. However, the widespread adoption of AI may also exacerbate educational inequities. Due to differences in technology, funding, and resources, there are significant disparities among regions and schools in the introduction and application of AI. Countries and regions with advanced technology and resources are more likely to benefit from the educational

transformations brought about by AI, while impoverished areas and disadvantaged groups may face greater challenges. The widening of this digital divide not only leads to further unequal distribution of educational resources but may also give rise to new social issues. Furthermore, algorithmic bias in AI is another significant factor affecting educational equity. As AI are often trained and optimized based on historical data, if biases or discrimination exist in the training data, the algorithms may exhibit similar biases in decision-making processes. In education, such algorithmic bias can result in unfair treatment of certain student groups in areas such as personalized learning and teaching evaluations. For example, if the training data primarily comes from students from middle- and high-income families in certain countries and regions, the AI may be more adept at providing customized learning resources and teaching plans for these students, while neglecting the needs of students from low- and middle-income countries and regions. Additionally, the handling of student data by AI may involve privacy and data security issues. If data protection measures are inadequate, it could lead to the leakage and misuse of student information, further exacerbating educational inequities, among other problems.

1. Technological Barriers

Technological limitations is the primary challenge for the application of AI in education. Despite significant advancements in AI in recent years, its practical application in education is still constrained by various factors such as algorithm accuracy, data quality, and computational resources. On the one hand, while machine learning algorithms have shown promising performance in personalized learning and teaching evaluation, their accuracy is still influenced by factors such as the quality of training data and model complexity. In practical applications, algorithms may fail to accurately identify students' true learning states and needs, leading to deviations in personalized learning paths. On the other hand, the collection and processing of educational data form the foundation for AI applications, but issues such as data quality, completeness, and privacy protection remain urgent to be addressed. data lack, data noise and data biases can result in inaccurate algorithm outcomes[3] and even give rise to ethical concerns.

[3] Data Noise refers to inaccurate, incomplete, or random interfering information mixed into data during the collection, storage, or transmission process, similar to “noise” in a signal.

2. Cultural Resistance

In addition to technological limitations, cultural resistance is also a significant barrier to the promotion of AI education. Educational philosophies, teaching methods, and cultural backgrounds vary across different countries and regions, which means that the introduction of AI needs to align with the local educational culture to maximize its effectiveness. In some countries and regions, traditional teacher-centered teaching methods still dominate, with caution or even rejection towards new technologies like AI. These differences in educational philosophies not only affect the speed of AI adoption but may also lead to the failure of technology application. Furthermore, students from different cultural backgrounds may have different preferences for learning styles and teaching content, which requires AI systems to possess cross-cultural adaptability to meet the needs of diverse students. However, current AI systems are often trained on data from specific cultural backgrounds, making it difficult to fully satisfy learning needs across different cultures. At the same time, some teachers are skeptical of new technologies, fearing that they may replace their roles or struggling to effectively apply AI for teaching innovation due to a lack of necessary technical training and support.

3. Social Ethics Ricks

The ethical risks arising from the integration of AI in education cannot be overlooked in AI applications. For example, how to ensure data privacy and security, how to avoid algorithmic bias, and how to address issues of data quality and completeness are all critical. Therefore, when leveraging AI for data-driven decision-making, it is necessary to pay attention to these potential risks and challenges simultaneously to ensure the fairness, transparency, and sustainability of such decisions. Firstly, the role of AI in the teaching and learning process needs to be clarified and reshaped. In education, teachers are the primary drivers of the teaching process, responsible for guiding the course flow and adjusting teaching content based on students' individual circumstances. The subjective status of teachers in the teaching process should be upheld, and the notions of “Techno-worship”[4] and “Optimism Bias”[5] towards technology should

be abandoned. On the one hand, teachers' subjective initiative is particularly important in the educational process. This is because education not only imparts theoretical and practical knowledge but also systematically guides students' worldviews, outlooks on life, and values based on their specific situations, which requires deep involvement from teachers. Even though AI can systematically assess students' learning status and ideological development and recommend different educational content based on their changes, it still falls short in terms of accuracy, stability, and time consumption. Meanwhile, counseling, as one of the main methods of education, mainly involves educators using relevant theories and methods to communicate with educational subjects, enhancing the pertinence and effectiveness of education. Heart-to-heart communication between teachers and students is a crucial means of effectively educating students regarding their ideological and moral development, an area where AI, lacking human consciousness and real-world social attributes, is at a significant disadvantage. On the other hand, people often have a positive bias towards technology, tending to trust the outcomes produced by AI. However, AI has not yet reached the stage of Artificial General Intelligence (AGI) or strong AI, and the data, algorithms, and models it relies on are all constructed and created by designers, inevitably infiltrated with different ideologies and values. The outcomes produced by AI do not align with people's expectations or understanding of “Algorithmic Neutrality”[6]. Algorithms can essentially be understood as “human ideas embedded in mathematics”. Therefore, we should maintain a rational approach towards AI and adopt a critical and selective attitude towards its output results.

[4] Techno-worship refers to the tendency to overly idealize, deify, or even become superstitious about science and technology, believing that technology can solve all problems and ignoring its ethical, social, and environmental risks.

[5] Optimism Bias is a cognitive bias that tends to amplify the positive effects of technology and selectively overlook potential negative impacts.

[6] Algorithmic Neutrality refers to the belief that algorithms should operate objectively and without bias, like mathematical formulas. However, in reality, algorithmic decisions are easily influenced by training data and the subjective choices of their designers.

Secondly, excessive digitization of the teaching process poses a threat to teachers' authoritative status. Teachers primarily undertake the important tasks of imparting knowledge, teaching skills, and resolving doubts. However, the high involvement of AI in the educational process may lead to neglecting teachers' leading role, thereby weakening their authoritative status. Compared with traditional classroom teaching, a teaching process highly involving AI may better adapt to students' specific circumstances, and with the development of digital teaching platforms, the time and scope for students to acquire knowledge will be expanded. In this case, students can access more high-quality learning materials tailored to their needs, feedback will be much faster than in traditional teaching, and learning time and location will be more flexible. But teachers do not have an advantage in terms of knowledge possession and teaching convenience.

Lastly, the digitization of educational subjects' learning information provides the possibility of overlooking the complexity of students' ideological, moral, and cultural aspects. Human ideological and moral cultivation is an extremely complex and constantly changing system, and currently, AI is temporarily unable to fully and multi-dimensionally digitize educational subjects' learning information. In AI, multifaceted learning information about educational subjects is digitized into “data packets”. While this may appear to be a comprehensive digital analysis of educational subjects' learning information, it essentially abstracts “real individuals” into “digital individuals”. This change ignores the complexity and reality of educational subjects as human beings, and long-term adoption of this approach can easily lead to erroneous ethical ideas such as dataism[7] that alienate individuals as social subjects. Therefore, education should adhere to the principle of putting people first, conducting education of different levels based on the varying ideological and moral standards of different educational subjects, emphasizing emotional expression and value guidance for educational subjects, and helping them form correct ethical ideas.

[7] Dataism is a decision-making paradigm whose core logic lies in regarding quantifiable data as the sole authoritative basis for understanding the world, advocating for the replacement of traditional empirical judgments or theoretical deductions with statistical patterns from large-scale datasets.

Relevant Documents Publicly Released by UNESCO

UNESCO believes that AI has brought significant benefits in many areas, but if no ethical framework is set for it, it may replicate real-world biases and discrimination, exacerbate social divisions, and threaten basic human rights and freedoms. For instance, AI business models are now concentrated in a few companies in a few countries, often developed by male-dominated teams. Moreover, half of the world's population still does not have access to a stable internet connection.

AI in UN and Authorized Organization's Public Documents

In October 2017, the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) released a "Study Report on the Ethics of Robotics". Chapter 3.5 of the report specifically addresses educational issues. On one hand, it points out that educational robots can be used to support individual and collaborative learning activities. Additionally, robots can serve various educational purposes and roles in the classroom, such as repeating words and sentences, and telling stories. On the other hand, the report raises the question of the role of robots. Should they be regarded as tutors, tools, or peers? Is there a risk of robots replacing teachers? Furthermore, the report discusses whether the application of robots in education, as a learning model, can truly motivate children's learning. Moreover, the introduction of robots into the education system is often closely related to a country's cultural values and sociopolitical economy. Learning motivation is a complex and multidimensional concept influenced by factors such as students' personal interests, family backgrounds, and sociocultural contexts. Relying solely on robots, a technological means, is hard to fully motivate all students. Moreover, excessive dependence on robots for teaching may weaken students' social skills and emotional development, an aspect not fully addressed in the report.

At its 40th session in November 2019, the UNESCO General Conference adopted Resolution ***40C/37***, authorizing the Director-General to "prepare, in the form of a recommendation, an international standard-setting instrument on the ethics of AI", to be submitted to the 41st session of the General Conference in 2021. Resolution ***40C/37*** is titled "Preliminary Study on the Feasibility of a Standard-Setting Instrument on the Ethics of AI". This document,

prepared by the COMEST Expanded Working Group on the Ethics of AI, mainly discusses ethical issues related to UNESCO's work. It highlights eight recommendations related to the education field, including elevating the concept of "lifelong learning" to a continuous education model, emphasizing AI literacy, critical thinking, and labor market adaptability in AI education, and ethical education for engineers. The document emphasizes that there is currently no global instrument that encompasses a people-centered approach to guide the development and application of AI in all areas. This text laid the foundation for the official issuance of the "Recommendation on the Ethics of AI" in 2021. However, it does not provide detailed plans and strategies for implementing the ideas mentioned in the text. For example, how to ensure that everyone has access to necessary AI education and training? How to evaluate the effectiveness and quality of AI education? These issues require further research and exploration. Additionally, although the document mentions ethical education for engineers, it does not provide specific instructions on how to conduct effective ethical education. Ethical education is not just about imparting knowledge; it is more important to cultivate students' ethical awareness and sense of responsibility. This requires specific teaching methods and evaluation mechanisms to support, which the document lacks.

At the 41st session of the UNESCO General Conference in November 2021, 193 Member States unanimously adopted the "Recommendation on the Ethics of AI". The development of this recommendation took two years and was the product of the broadest global consultation process involving experts, developers, and other stakeholders from around the world. It is also the first global agreement addressing ethical issues related to AI. The document pays special attention to the potential ethical implications of integrating AI systems into education. Firstly, starting from the impact of AI on the labor market, employability, and civic participation, the document points out that individuals living in digital societies need new educational practices, ethical reflection, critical thinking, responsible design practices, and new skills. Secondly, the document states that all actors in the lifecycle of AI systems should adhere to sustainable education goals, such as promoting international cooperation from an equitable perspective to avoid educational deficiencies in certain communities; emphasizing the leadership and participation of diverse social entities; providing accessible education, digital skills, and training on AI ethics, media, and information

literacy to citizens, and promoting public awareness and understanding of the value of AI technologies and data. Furthermore, the document specifically discusses the gender equality perspective, emphasizing the need to formulate policies aimed at supporting girls and women, such as ensuring that labor and education policies do not exclude women from the AI-driven digital economy and ensuring that AI systems contribute to realizing the potential for gender equality. Finally, the document encourages Member States to conduct research activities on the application of AI technologies in teaching, teacher training, and e-learning in a responsible and ethical manner, while emphasizing the value of interpersonal and social aspects and traditional forms of education for teacher-student relationships and relationships among students. Although the document focuses on the potential ethical implications of integrating AI systems into education, it does not provide clear guidance and suggestions on how to specifically address these ethical implications. For example, how to ensure that the introduction of AI technologies does not exacerbate educational inequality? How to ensure that the design and use of AI systems conform to ethical principles? These issues require more specific policies and measures to address. In addition, while emphasizing the leadership and participation of diverse social entities, the document does not fully explore how to balance the interests of different stakeholders. In the field of education, governments, schools, teachers, students, parents, etc., all have different interests and expectations. How to ensure that the rights and interests of these stakeholders are fully respected and protected is a key issue that needs attention in the application of AI in education.

Rationale for the Relationship between AI and Sustainable Development

Under the framework of the 2030 Agenda, AI, as an important driver for achieving Sustainable Development Goals (SDGs), has received widespread attention. This trend runs through all goals from SDG1 to SDG17, including ecological environment protection, economic construction, social equity and justice, culture, and governance. Astobiza (2021) believes that digital technology can be used to solve major human problems, including the 17 sustainable development goals and 169 sub-goals in the 2030 Agenda. At the same time, researchers are also concerned about the possible counter-effects of AI on sustainable development. For example, some views point out that the increased utilization of AI may

exacerbate global economic inequality and create a human survival crisis, thus hindering sustainable development. Ricardo (2020) and others analyzed the positive or negative impact of AI on sustainable development goals. The results show that AI can support the achievement of 134 sub-goals of all sustainable development goals, but may also inhibit the achievement of 59 sub-goals. In order to fully grasp the relationship between AI and sustainable development goals, Ivan (2021) gave high expectations to the realization of sustainable development goals promoted by AI from the basic perspectives of six dimensions of human needs life, economic and technological development, social development, equality, resources, and natural environment, and built a panoramic view using the SWOT theoretical framework. In addition, academia has also explored the ideas and methods of combining AI with specific industries to promote sustainable development, such as promoting sustainable development of tourism through AI, the application of AI in smart libraries, the application of AI in regulatory activities, and other issues.

The existing studies on international governance of AI, the combination of AI and sustainable development, and the technical concept of sustainable development all provide rich theoretical support and literature basis for this article. Current research generally recognizes AI as an important tool for promoting SDG4. However, there are still significant limitations in existing research: firstly, the fragmentation of research perspectives, with a focus on a single industry or specific goal (such as environmental or economic fields), and a lack of dynamic analysis of cross-goal synergies and conflicts; secondly, the weakness in ethical and social dimensions, with an over-reliance on technical efficiency assessments and a neglect of long-term risks such as algorithmic bias, labor substitution, and cultural marginalization; and thirdly, the prominent geographical bias, with cases mostly concentrated in high-income countries and insufficient attention paid to technological adaptability and localized innovation in low-income regions.

Concrete Responses to United Nations' Guiding Documents Across Nations

Concreting the United Nations' guiding document, nations are effectively formulating region-specific strategies for digital educational transformation, imbued with the power of AI, each reflective of their respective developmental stages of education. The process encompasses several facets:

Primarily, nations are ardently embracing the policy suggestions of the UNESCO. With reference to UNESCO's prior instructive documents, these nations have crafted corresponding strategies for effecting a national digital transition in education, enabled by AI. For instance, China's Deputy Minister of Education, Sun Yao, articulated that the country, on the basis of the 'Beijing Consensus', has enacted a 'Digital Education Action Strategy'. South Korea, taking cues from UNESCO's 'Artificial Intelligence Ethics Recommendations', has formulated specific ethical principles for the application of AI within the educational sphere. As of July 2024, 6 African nations-Algeria, Benin, Egypt, Mauritius, Rwanda, and Senegal-have all developed independent AI strategies from the perspective of third-world countries. Meanwhile, countries including Ethiopia, Ghana, Kenya, Mauritania, Morocco, Nigeria, South Africa, Tanzania, Tunisia, and Uganda have made significant progress in formulating AI policies and establishing institutional frameworks to advance artificial intelligence development.

Next, the collaboration between UNESCO and diverse nations facilitates addressing of regional educational issues. Slovenia took the pioneering step of establishing the first international AI research center - the International Research Centre on Artificial Intelligence (IRCAI) under the auspices of UNESCO. Administered by the International Science Council, the center harnesses AI algorithms to augment the content quality and accessibility of Slovenia's open digital education resources.

Lastly, the establishment of innovative, professional academic AI institutions is empowering the digital transition across industries. For example, Mohammad Bin Zayed University of Artificial Intelligence (MBZUAI) stands as the world's premier university with a focus on AI. The institution's foundational objective is to concentrate on postgraduate level cultivation and application technology development within the realm of AI, striving to drive digital transformation across various disciplines through a profound integration with AI.

Devising Strategies to Facilitate Global Sustainable Development Through AI Education.

In May of 2022, the United Nations hosted the third World Higher Education Conference, a summit concentrated on the reshaping of education and sustainable development, underscoring the imperative of innovative progress in education. The social rivalry in the age of intelligence no longer solely consists of human competition; a plethora of procedural and non-creative vocations are poised to be supplanted by automated, intelligent machines. Labourers can only resist obsolescence by machines if they possess superior high-level cognition and capabilities. The transformation in the quality of the workforce imposes new demands on the objectives of talent cultivation, making the nurturing of students' innovative spirit, creative thinking, and innovative skills an urgent task for every educator (Yang, Z., Wang, J., Wu, D., & Wang, M.,2022).

Fostering Global Citizens with Proficiency in Artificial Intelligence and a Sustainable Development Ethos

Confronted by the exponential advancement and pervasive application of AI, societal constructs, production procedures, and even our modes of living are undergoing transformative evolution. To adapt and proactively address this unprecedented shift of a century, there is an urgent need to cultivate global citizens adept in the principles of AI and well-versed in sustainable development.

Initially, we must instigate educational reform to nurture AI-thinking. This transformation encompasses not only the proliferation of fundamental programming and machine learning knowledge but, more crucially, facilitating citizens to comprehend and assimilate AI thinking. This form of cognition, rooted in data and algorithms, hinges on understanding the foundational principles of algorithms and data, and applying AI within specific contexts to resolve tangible issues. To achieve this goal, it is necessary to reform existing curricula. Educators need to collaborate with technology experts to integrate programming, data ethics, and sustainable development cases into basic education curricula. Governments should also establish special funds to support teacher training and develop curriculum standards to ensure that the cultivation of AI thinking covers both urban and rural schools, so that primary and secondary school students in the basic education stage can be systematically trained in their digital competencies through information technology courses.

Secondly, we must strengthen the nurturing of a sustainable development ethos amongst citizens, deepening their understanding of sustainable development principles. These principles advocate for equilibrium amongst economic, societal, and environmental dimensions. Hence, citizens must grasp these dimensions' interrelations and how they can support sustainable development through precise actions and decisions. To attain this goal, clear educational objectives, curriculum content, and academic standards must be established, integrating AI education into compulsory education, high school, and university curricula. In this process, an interdisciplinary fusion is a vital strategy, combining knowledge from disciplines such as computer science, mathematics, physics, engineering, biology, sociology, and the arts to foster a sense of responsibility for sustainable development in students across all fields.

Narrowing the Digital Divide, Preventing AI from Exacerbating Social Inequality

Technological innovations in information and the development of AI have undoubtedly provided new impetus for enhancing productivity. However, these advancements may also exacerbate the digital divide and further deteriorate social inequalities. Currently, the digital divide issue is mainly manifested at three levels: the traditional digital divide, the new digital divide, and the intelligent divide. Among these, the intelligent divide is the most critical, as it reflects whether individuals can understand and adapt to information technology driven by internet technology and AI, thereby promoting coordinated development of individuals and society.

To address this issue, first, priority should be given to the development of AI-driven smart education. By leveraging new-generation information technologies such as 5G, it is possible to resolve the uneven distribution of high-quality educational resources and explore new service models to bridge the digital divide. For areas with insufficient network coverage, technical teams can develop edge computing-driven AI tools (such as localized language processing models) and collaborate with educators to design offline teaching resource packages.

Second, it is essential to promote the professional development of teachers in deep integration with AI. Enhancing teachers' information technology application capabilities and cultivating their AI mindset are crucial for adapting to the era of AI education, improving teaching quality, and fully developing students' potential.

Finally, it is important to strengthen the cultivation of a lifelong learning concept throughout society. With the development of AI technology, the pace of knowledge updating is accelerating, and changes in the labor market are becoming more drastic. Therefore, promoting the concept of lifelong learning and autonomous learning, and enhancing individuals' self-improvement capabilities, are effective ways to cope with this uncertainty.

Cultivating an Equitable and High-Quality AI Educational Ecosystem.

To foster the integration of AI with education, it is essential to scrutinize its adaptability in relation to the characteristics of educators and students, the knowledge structure, and the external institutional mechanisms, all viewed through the lens of sustainable development.

To this end, a strategic design for AI education should be envisioned from a global perspective. A global development plan for AI education must take into account regional disparities, striving for a judicious balance between development and governance. It is imperative to craft an AI education blueprint that will facilitate the future development process and provide a structural framework for constructing an equitable and high-quality AI education ecosystem. For governments of various countries, it is necessary to formulate targeted policies to promote their own national development, clarify regional differentiation strategies, and establish cross-border data sharing and privacy protection agreements.

AI in education primarily investigates the transformative repercussions induced by the comprehensive, processual, and elemental integration of intelligent technologies into pedagogy, encompassing the reshaping of philosophical underpinnings, structural reorganization, process reinvention, content restructuring, and model reconstruction. At present, the elucidation of the educational laws, cognitive mechanisms, and developmental trajectories pertaining to the incorporation of AI in pedagogy remains nebulous in many nations. Consequently, nations ought to meticulously devise holistic strategies and systematically lay out cooperative innovation research related to intelligent education, amalgamating the advantageous forces of relevant disciplines. By harnessing the dual propulsion of knowledge and data, they should probe into the underlying principles of AI education. Furthermore, there should be fervent promotion of the intelligent upgrade of educational

facilities, constructing a more immersive, interconnected, open, and intelligent pedagogical environment. It is imperative to tightly interweave the evolution of intelligent education with the traditional cultures of various nations, focusing on core concepts and exclusive propositions reflective of local characteristics. Strengthening collaboration with relevant international organizations is equally paramount (Y., Wan, K., & Feng, Y.,2019).

Upon this premise, efforts must be concentrated on establishing an AI education system inclusive of policy support, educational resources, educational research, and practical implementation. This structure should foster coordination and interaction between the various elements, engendering a virtuous cycle. This not only involves encouraging and ensuring active participation from diverse stakeholders such as governments, educational institutions, businesses, and research institutions but also necessitates a proper understanding of the structural relationships between individuals, families, societies, and nations - hence, converging values from various dimensions to cater to the demands of the era.

Infusing the Principles of Sustainable Development into AI Education.

Governments of all countries should actively participate in and promote the design and formulation of international standards to regulate the ethical risks of AI in education, such as requiring enterprises to disclose algorithm logic and establishing independent review bodies to supervise technology applications.

First, fairness forms the crux of ethical principles. Regardless of ideological affiliation, economic progress, or geographical location, all individuals should have equal opportunities to access and utilize AI educational resources. This requires attention towards narrowing the digital divide, promoting technological ubiquity, and ensuring that all groups, especially disadvantaged ones, can equitably enjoy the educational opportunities and benefits brought forth by AI.

Secondly, the principle of inclusivity is integral to AI education. The education system should respect and adapt to diverse educational needs and cultural backgrounds, allowing the exploration of multiple educational pathways and methods to meet differentiated learning needs. Hence, the inclusivity principle also stresses the necessity of considering diversity and differentiation when designing and implementing AI education.

Lastly, transparency is a pivotal ethical principle. With the evolution of AI, the advantages of unsupervised learning methods in data clustering compared to supervised learning are gradually being exploited and made apparent, thereby sparking concern over the "transparency of decision-making systems". Current research in this field demonstrates that achieving "transparency" still faces tangible challenges such as "algorithm embodiment" and "interest properties of datasets". Therefore, it is necessary to clarify the connotations and extensions of "transparency", and design AI models based on "privacy ethics" that consider key elements of "transparency" including data types, target groups for data services, purposes of data usage, and scope of data transmission.

Establishing a Synergistic Relationship between Humanity and Technology for Mutual Empowerment

While AI offers convenience in education, it also engenders an array of issues such as increasing dependence on AI, reversal of roles between humans and machines, and the potential for AI to mislead humans, thus inciting anxiety around AI education. Measures to alleviate this anxiety may include enhancing technological methods, reinforcing human-machine collaboration mechanisms, and the rational utilization of AI.

To begin with, there should be a substantial increase in the intensity of research into front-end sensing for data acquisition by AI. Our perception of the world influences and determines our judgement thereof. From the perspective of data collection by AI, the current AI perceptual system has yet to reach a level of precision in describing and replicating the world, and still lacks "feelers" across many dimensions. Therefore, increased investment into front-end sensing research in AI is required to capture more comprehensive, multidimensional data, better serving the users.

Next, the combination of human intelligence and AI, each complementing the other's strengths, would leverage the efficacy of AI and gradually foster an interactive and increasingly integrated relationship between humans and technology. The domains where human intelligence and AI excel are distinct; their collaborative operation, interaction, and mutual empowerment can create a holistic effect. The efficacy of this combined operation surpasses or equals the sum of the efficacies when human intelligence and AI function individually, thereby mitigating the anxiety surrounding dependency and misinformation in AI education.

Lastly, AI should be applied rationally. We must respect the educational laws of human physical and mental development, firmly holding onto the right to make educational decisions and the autonomy to choose learning plans. This technology should be applied with a dialectical perspective, avoiding complete reliance on AI and preventing it from becoming a limiting factor in human potential development.

Conclusion

Based on relevant United Nations documents, the pivotal role of AI education in promoting global sustainable development goals can be clearly discerned. Several UN documents emphasize that the global development of AI education has become the driving force behind modernizing education and achieving global sustainable development goals. Confronting increasingly complex educational development trends, the opportunities and challenges brought by AI have become the strategic choice for achieving global high-quality education.

In essence, the propulsion of intelligent technology has ushered human society into a new epoch characterized by digitalization and intelligentization, thereby engendering a significant shift in the objectives of talent cultivation. Technological innovation lays the cornerstone of productivity for the development of this new era, and the escalation of productivity will catalyze profound transformations in the relations of production, reshaping the modes of social production and lifestyle. Intelligent technology accelerates the explosive growth of the information space, merging reciprocally with the physical and social spaces, thus forming a trinity of “information-physical-social” spaces that sustain human production and practice in this new epoch. Intelligent technology is swiftly integrating deeply into various sectors, ceaselessly giving birth to novel applications, models, and industries, facilitating the digital transformation, intelligent upgrade, and integrated innovation of the entire society. The discrepancies in understanding and interaction limitations between AI and human intelligence will gradually attenuate, and bidirectional cooperation between intelligent machines and humans will yield a human-centered, reality-virtuality blended intelligent societal form. This emergent form will precipitate significant transformations in existing production modes and industrial forms, making the social division of labor increasingly intricate and necessitating higher quality standards for laborers.

In light of this, it is crucial to enhance the global emphasis on the development of AI education, deeply participate in the planning and practice of AI education, rationally address various predicaments that have emerged or may arise in the integration of AI with education, strengthen technical support and ethical norm construction, so as to ensure that AI education can make a positive contribution to achieving global sustainable development goals.

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