# Achieving quality education: present and future

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**DOI: 10.29180/978-615-6886-27-9_7**

**Abstract**

This paper explores disparities in access to quality education through a qualitative analysis of UNESCO's 2007 comparative study of 16 of the most populous and largest countries across Africa, Asia, and Latin America – as well as Canada, the Russian Federation, and the United States - supplemented by some frameworks from UNICEF and Sustainable Development Goal 4 (SDG 4). The qualitative methodology is based on document analysis and the interpretation of key indicators such as enrolment ratios, expenditure per pupil, and pupil-teacher ratios to evaluate horizontal equity within national education systems. The findings reveal significant regional disparities in both access and resource allocation. While countries such as Canada, Peru, and Mexico show relatively low disparities, India, Brazil, and Pakistan experience pronounced inequalities, especially in secondary education. Generally, wealthier regions demonstrate higher enrolment and better resource provision, though exceptions exist, such as higher primary enrolment in some poorer areas. In defining quality education, the paper draws on UNICEF and SDG 4 frameworks, emphasising inclusive environments, relevant curricula, and measurable outcomes. The study also considers the emerging role of artificial intelligence (AI) in improving access to education and personalisation. While AI offers promising solutions for addressing disparities, its implementation must be carefully managed to ensure equity and long-term sustainability.

**Keywords:** Quality Education, Educational Equity, Sustainable Development Goal 4 (SDG 4), Artificial Intelligence in Education, Educational Disparities

**JEL classification:** I2, I24, O33, H4, F01

## UNESCO's case study on 16 countries – disparities in primary and secondary education

In the essay, I focus on the 16 countries compared in UNESCO's 2007 study. The above-mentioned countries are among the largest and most populous in the world.

The study presents three countries in Africa (Egypt, Nigeria, and South Africa), five in Asia (Bangladesh, China, India, Indonesia, and Pakistan), five in Latin America (Argentina, Brazil, Ecuador, Mexico, and Peru), and another 3 - Canada, the Russian Federation, and the United States. (UNESCO Institute for Statistics, 2007)

UNESCO's study compared countries on their key aspects of educational policy and tried to assess the relative equity of their education systems - this was all based on the differences in access to education and the provision of educational resources provided for public education.

First, the 16 countries were reviewed in relation to their relative standing on horizontal equity, based on three equity dimensions: enrolment ratios, expenditure per pupil, and pupil-teacher ratios. Those countries that ranked at the top had relatively small disparities across their regions, while those in the middle had moderate disparities.

**Access to education: Enrolment ratios**

Nine countries' reports were reviewed in this part; their primary and secondary education enrolment were both examined.

- Mexico had relatively small disparities (at both educational levels),
- Egypt and the Russian Federation had small disparities.

- Large regional disparities were evident in the case of India and Brazil.

Among countries that reported only their primary enrolment ratios, China had relatively small disparities, whereas in Bangladesh and Pakistan, they were relatively large. As for secondary education, disparities in enrolment ratios were relatively small in Canada and the United States.

**Educational resources: Expenditure per pupil and pupil-teacher ratios**

- Smaller interregional disparities in expenditure per pupil for primary and secondary education: Canada, Peru, South Africa, and the United States showed the following trends:
- In pupil-teacher ratios in primary education, disparities were smallest in Argentina, Brazil, Indonesia, Mexico, and Peru.
- Moderate range: Bangladesh, China, Ecuador, and the United States.
- Largest: Egypt, India, Nigeria, and Pakistan.
- As for the disparities at the secondary level, pupil-teacher ratios showed some similarities and some differences with primary education:
- China, Indonesia, Mexico, and Peru showed the smallest differences.
- Brazil, Ecuador, Egypt, and the United States were in the moderate range,
- While in Argentina, India, and Pakistan, they were the largest.

**Relationship between regional wealth and regional enrolment ratios**

**Access to education - Enrolment ratios:**

Taking this equity dimension into account, Egypt, Mexico, and Peru performed the worst. Between regional wealth and enrolment ratios in both primary and secondary education, there were moderate-to-strong positive relationships.

In Argentina, Brazil, Canada, India, Indonesia, South Africa, and the United States, wealthier regions had higher secondary education enrolment ratios.

It was noticeable that, in the poorer regions of four countries (Argentina, Brazil, India, and South Africa), enrolment ratios were higher in primary education, with India the only country with a strong relationship.

Educational resources - Expenditure per pupil and pupil-teacher ratios

It was evident that wealthy regions were able to provide greater expenditure per pupil for primary and secondary education in 10 countries (at least, where data were available). The countries where the relationships were strong were Argentina, Brazil, Canada, China, South Africa and the United States, while in Egypt, Mexico, Peru, and the Russian Federation, they were moderate.

In Argentina, Brazil, Canada, China, Egypt, India and Peru, lower pupil-teacher ratios in wealthier regions were associated with higher levels of expenditure. Wealthier regions had lower pupil-teacher ratios in primary education in Argentina, Brazil, China, Egypt, India and Peru. The same was true for secondary education in six countries (including Mexico).

To summarise this chapter, UNESCO's 2007 study clearly showed both similarities and differences among the 16 examined countries. What made this study special was that these countries were located on three different continents; therefore, circumstances and other vital factors could show major discrepancies.

In my opinion, the level of education shall improve in every country, not just in the 16 examined. One way to achieve this is through the effective use of artificial intelligence.

### *Quality education*

*Definition*

It is challenging to provide an exact definition of quality education as there are many different views on this topic. In this section, however, I will attempt to summarise the essence of the concept.

*UNICEF's definition at the meeting of the International Working Group on Education (Florence, Italy, June 2000)*

The paper published in connection with the aforementioned meeting does not define quality education; rather, it focuses on key areas that can be included in this concept. These areas are the following:

a) Learners who are healthy, well-nourished, ready to participate and learn, and supported in their learning by their families and communities; (UNICEF, 2000)
b) Environments that are healthy, safe, protective, gender-sensitive, and that provide adequate resources and facilities;
c) Content that is reflected in relevant curricula and materials for the acquisition of basic skills, especially in literacy, numeracy and life skills, as well as knowledge in areas such as gender, health, nutrition, HIV/AIDS (prevention and peace). HIV is a pathogen that attacks the human immune system, causing immunodeficiency, and can also directly attack certain human cells (nerve cells, bone marrow, skin, and certain intestinal cells) (HIVInfo, s.a.). It is one of the retroviruses, which are characterised by their ability to insert their entire genetic information (genome) into the host cell genome. (In other words, they penetrate the cell, insert their own genes into its DNA, and use it to produce new viruses that infect other cells.)
d) Processes through which trained teachers use child-centred teaching approaches in well-managed classrooms and schools, and skilful assessment to facilitate learning and reduce disparities;
e) Outcomes that encompass knowledge, skills and attitudes, and are linked to national goals for education and positive participation in society.

Of course, in addition to the above, it should be noted that many authors have different perspectives on the topic. What can also be stated, however, is that there is considerable consensus concerning the basic dimensions of quality education today.

*SDG 4 definition of quality education*

The 4th Sustainable Development Goal gives the following definition of quality education: *"SDG4 can be seen as a commitment to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.'"* It can also be counted as a pivotal driver for positive change: something that emphasises the transformative power of education in fostering a sustainable and equitable world.

*A general overview of how effectively quality education is implemented in practice*

About a decade ago, UNESCO published a comprehensive report that provided insight into how countries were accelerating progress towards the global Sustainable Development Goal on education (SDG 4). The report highlights examples of countries' actions to transform their education systems (UNESCO, 2015).

In this section, I will outline seven ways in which education systems can be improved based on the findings of the Transforming Education towards SDG 4: *'Report of a global survey*

*on country actions to transform education'*, published ahead of the 2024 Global Education Meeting. (UNESCO, 2024)

a) Exploring multiple paths to transforming education:

The necessity of a multifaceted, context-specific approach to transforming education is emphasised. It is important to note that different countries are at different stages of their educational transformation journeys and are adopting various approaches to address their specific needs.

b) Securing consistent funding for education:

Financing must be prioritised and sustained, and innovative measures must be adopted to accelerate transformation. Without sufficient funding, the quality of education can deteriorate, adversely affecting the future of countless learners.

*How can countries improve this action?*

They can do so by increasing investment in education from all sources, including international aid and innovative financing, to meet their SDG 4 targets while ensuring the efficient and effective use of resources.

To achieve effective education financing, the following methods are required:

- cutting inefficiencies
- enhancing governance
- linking investments to education outcomes, while focusing on maximising impact and accountability.

c) Prioritising inclusion, equity, and gender equality in education

These factors are essential for achieving quality education and can serve as guiding principles for countries seeking to transform their education systems.

d) Embracing digital transformation to drive educational change

Digital transformation is essential to transforming education: countries are focusing on enhancing connectivity, digital resources, and educator training.

e) Investing in teachers to transform education

This factor includes the following:

- enhancing professional development,
- equipping teachers with new pedagogical skills, digital tools, and updated curricula.

f) Adopting a holistic, lifelong approach to transforming education and supporting individual and societal well-being

Transforming education requires a comprehensive and integrated approach: one which reimagines curricula, teaching methods, and lifelong learning opportunities.

g) Engaging stakeholders, especially the youth and students, to transform education meaningfully

An increasing number of countries are recognising the importance of incorporating youth engagement into their governance frameworks, thereby ensuring that the voices of those directly affected by educational transformation are included in policies and decision-making processes.

In conclusion, transforming education is essential. In this regard, innovations, digital and technological developments, such as artificial intelligence, can play a crucial role. Additionally, eliminating inefficiencies and prioritising inclusion, equity and gender equality in education are essential to improving its quality.

**Targets and indicators of SDG4**

This chapter covers all the targets of SDG4, along with some indicators I found most relevant. Target 4.1. Determines that by 2030, all girls and boys should have access to free, fair, and high-quality primary and secondary education that leads to relevant and effective learning outcomes (United Nations, 2015).

Indicator 4.1.1: Indicator 4.1.1 states that children and young people in Grades 2/3, at the end of primary education, and at the end of lower secondary education should achieve at least a minimum proficiency level in reading and mathematics, with results reported by sex.

Indicator 4.1.2 focuses on the completion rate of primary, lower, and upper secondary education.

Target 4.2 aims to ensure that by 2030, all girls and boys have access to quality early childhood development, care, and pre-primary education, so they are prepared for primary education.

Indicator 4.2.1: contains provisions on the proportion of children aged 24–59 months who are developmentally on track in terms of health, learning and psychosocial well-being, broken down by sex.

Indicator 4.2.2: emphasises the participation rate in organised learning (one year before the official primary school entry age), broken down by sex.

Target 4.3: aims to ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university, by 2030.

Indicator 4.3.1 examines the participation rates of young people and adults in formal and non-formal education and training over the previous 12 months, broken down by sex.

Target 4.4: Within five years, there should be a substantial increase in the number of young people and adults with the relevant skills for employment, decent jobs and entrepreneurship, including technical and vocational skills.

Meanwhile, indicator 4.4.1. is concerned with the proportion of young people and adults who have information and communications technology (ICT) skills, categorised by skill type.

Target 4.5.: By 2030, gender disparities in education are to be eliminated, with equal access ensured at all levels of education and vocational training for vulnerable groups, including persons with disabilities, indigenous peoples and children in vulnerable situations.

Indicator 4.5.1: focuses on parity indices, differentiating between female and male, and between the bottom and top wealth quintiles, as well as mentioning other factors such as disability status, indigenous peoples, and conflict-affected populations, for all education indicators.

Target 4.6.: states that all young people, as well as a substantial proportion of adults, both men and women, shall achieve literacy and numeracy.

Indicator 4.6.1: ensures that a given proportion of the population in each age group achieves a minimum level of proficiency in functional literacy and numeracy.

Target 4.7: makes sure that, within five years, all learners have the knowledge and skills needed to promote sustainable development. This will be done through education for sustainable development and sustainable lifestyles, human rights, gender equality, the promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and culture's contribution to sustainable development.

Indicator, 4.7.1. focuses on the extent to which global citizenship education and education for sustainable development are incorporated into national educational policies, curricula, teacher training and, finally, student assessment.

Target 4.a. states that building and upgrading child-, disability- and gender-sensitive education facilities is essential, as is providing safe, non-violent, inclusive and effective learning environments for all.

Indicator 4.a. focuses on the proportion of schools offering basic services.

Target 4.b: ensures that in five years the number of scholarships available shall be substantially expanded globally to developing countries - in particular in least developed countries, small islands, developing states, and African countries, for enrolment in higher education, including vocational training and information and communications technology,

technical, engineering and scientific programmes, in developed countries and other developing countries.

Target 4.c: states that by 2030 the supply of qualified teachers will have increased substantially, particularly in developing countries, least developed countries and small island developing states, through international cooperation for teacher training.
Finally, its indicator 4.c.1 concerns the proportion of teachers who have the minimum required qualifications for their level of education.

**The emerging role of AI in quality education**

Artificial intelligence (AI) began to emerge several decades ago (Seifedine K., ed., 2024). The term "artificial intelligence" was coined by John McCarthy, often regarded as one of the founding figures of the field (Iberdrola, n.d.). McCarthy also played a key role in developing LISP (LISt Processing), one of the earliest programming languages specifically designed for artificial intelligence research. Created in the late 1950s at the Massachusetts Institute of Technology under McCarthy's leadership, LISP was intended to facilitate operations involving symbolic expressions. Its development was motivated in part by the need to address problems in computer algebra, such as the formal differentiation of mathematical expressions, as well as by efforts to create programs capable of logical reasoning, such as the "Advice Taker" system (Szépkúti, 1991). Despite its early origins, LISP continues to play an important role in certain areas of AI research today.
Artificial intelligence (AI) has advanced significantly over recent years and decades and is now widely used across various fields, including education, which is often considered one of its most important areas of application. AI is frequently described as the design and development of intelligent agents that perceive their environment through sensory data and act in ways that influence that environment. It can also be understood as a field within computer science, as it relies on algorithms and machine learning techniques to replicate or simulate aspects of human intelligence. In the following section, I consider several key aspects of the three main types of artificial intelligence. These are the following:

- Narrow AI: It is the most common and realised form. Some of its additional features include being goal-oriented and employing machine learning to realise a task.
- General AI (also known as "Deep AI"): It is deemed on par with human capabilities, which can discern the needs or emotions of other intelligent beings.
- Artificial superintelligence

**The connection between quality education and AI**

In addition to what is covered in the second part, quality education can be described as a holistic educational approach that provides learners with academic knowledge, critical thinking, problem-solving skills, creativity, and—last but not least—a sense of social responsibility.

Quality education should also have the following features:

- Inclusivity, equity, and accessibility for all learners
- Promotion of lifelong learning
- Preparation of recipients for active participation in society
- Serving as the foundation for individual growth and global societal development
- Contributing to societal progress by promoting social integration, reducing inequality, and fostering the development of an informed and engaged citizenry.

It should also be noted that nations where citizens receive quality education are better prepared and equipped to address the challenges of poverty, health and environment. These

nations more often than not develop better innovations and adapt more easily and favourably to the demands of a rapidly evolving economy. Quality education is a major driving force for achieving sustainable development and progress in societies, while simultaneously shaping and empowering individuals.

Regarding the relationship between artificial intelligence (AI) and quality education, it should be noted that AI can be used to support personalised learning, instructional systems, educational analytics, etc. Furthermore, artificial intelligence-powered learning management can be seen as a major development in achieving quality education. This is supported by the fact that learning analytics can significantly enhance understanding of learning processes within the field of learning sciences, both theoretically and in practical applications. Continuing this line of thought, through data analysis, AI can optimise content delivery in the following ways:

- personalising learning paths,
- accessing learners' performance, and
- improving engagement with adaptive learning techniques. (University of New York in Prague, 2024.)

Another advantage of AI is that it easily adapts to the needs of learners, provides content and feedback, and effectively actualises learning outcomes. Furthermore, teachers can use it to create more effective lesson plans and assessments. Artificial intelligence can also assist them in guiding learners to achieve the best possible outcomes.

As for helping students, AI has the potential to become a companion and/or an assistant. The main reason for this is that artificial intelligence is able to assess students' strengths and weaknesses. It can also analyse the learner's pace and identify their latent skills as well, which is important because it could bring out the best in the students.

From the perspective of this study, it may be useful to examine some AI-powered Learning Management Systems (LMS), defined as software applications used to plan, deliver, and monitor training and educational programmes. (SAP., s.a.)

- Zavvy: an AI-powered LMS that is known for its features that can be used to create engaging training courses in a very short duration. It's also effective for assisting in launching workshops, creating (on-demand) courses, and it is also an advantage that it is faster than traditional learning platforms, e.g. classic classrooms.
- Paradiso: an AI-powered authoring tool that is useful for creating e-learning courses, helping users generate content, images, presentations, and videos, which can later be transformed into training materials.
- Docebo: Provides efficient and customised learning programs which contain special features for creating audience-specific pages by using drag-and-drop functionality. It supports auto-tagging, content suggestions, and customised learning experiences through virtual coaching, thereby enhancing personalised learning.

Additionally, AI-powered intelligent classroom assistants - such as Squirrel AI, Edmodo, or Brainy - can also enhance the quality of education. AI can also enhance personalised and individualised learning by adapting to individual learners' requirements, while also improving the grading systems used in the educational sector. It also promotes global access to quality education for users all over the world through global classrooms. Last but not least, it is useful because it can adjust learning paths, predict learners' needs, and is also accessible and inclusive.

By using artificial intelligence, countries can achieve quality education more easily. In developed countries, AI is used more often; however, given the targets and indicators of SDG4, quality education could be achieved more easily globally. It would require technological development worldwide, starting in developing countries.

The field of education is constantly evolving. Currently, the Council of Europe is organising a 3rd working conference on the topic of ensuring Quality Education in the AI Era.

(Council of Europe, 2025.) Their main goal is to “develop each pupil’s and student’s personality, talents, and mental and physical abilities to their fullest potential”, “recognise everyone’s learning and social needs”, “enable pupils and students to develop the necessary skills, self-confidence, and critical thinking to become responsible citizens”, and “rely on qualified teachers”.

Therefore, they are proposing a new strategic tool to operationalise the values of AI: the Compass for AI and Education. It is structured around five key components. These are the following: Evaluation, Governance, Literacy, Practice and Regulation. The Compass will be significant for providing member states and stakeholders with standards and guidance to ensure that AI contributes to democratic participation, human dignity, the integrity of educational institutions, and quality education. As educators, civil society and the private sector, together with students and governments, are invited to the conference, the Council of Europe is reaffirming its commitment to shaping a future in which AI contributes to quality education.

## Conclusion

The above targets and their indicators broadly define sub-goals that must be achieved under SDG4. They address areas such as scholarships, the development and upgrading of educational facilities, global citizenship education, and education for sustainable development, among others. It should also be noted that these targets and indicators often place special emphasis on developing countries—particularly least developed countries, African nations, and small island states. This focus reflects several challenges faced by these regions, including limited access to educational infrastructure, shortages of schools and qualified teachers, and the marginalisation of certain population groups, all of which can contribute to higher proportions of children and adults who are uneducated or undereducated.

Furthermore, recent studies suggest and confirm that AI-based personalised learning tools can improve student engagement and learning outcomes. In addition to the aforementioned, virtual tutors and assistants should also be mentioned, as they are becoming a valuable resource for students.

Not surprisingly, higher education shall also not be left out of technological improvement. So-called „smart campuses” are emerging where AI helps streamline everything from administrative tasks to student services. AI chatbots, like those used by universities in the United States of America and the United Kingdom, assist students with registration, scheduling, and accessing resources such as libraries and counsellingservices.

Last, but not least, AI is being used in research labs to assist students and faculty with data analysis, predictive modelling, and even grading – all of which help reduce professors' workload and enable more focus on creative and critical thinking. Consequently, artificial intelligence may help improve the quality of education, but it is important to handle this topic cautiously, as AI still needs to be developed in several fields.

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