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Bridging the divide: A review of global gaps in PISA performance

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Abstract

The world's widest and most elaborate test of student performance, the Programme for International Student Assessment (PISA), monitors how countries measure up to average in preparing their 15-year-olds for the 21st century. Yet PISA results routinely show huge cross-regional disparities, with East Asia and Scandinavia consistently at the top of the rankings and many nations in Sub-Saharan Africa and Latin America failing even to reach world averages. The reasons for these performance gaps are explored in this article by addressing the effect of socioeconomic inequality, teacher quality, technology access, and cultural values on the development of these systems. The article uses regional analysis and case studies of similar successful education systems in Finland and Singapore to identify ways to compensate for such displacing differentials. Drawing on the roots of its tradition of exchange over the centuries, it emphasizes the need to tailor reforms to local contexts and to build on ongoing international collaboration. It offers actionable recommendations for closing global education gaps. In the future, technology, equity-focused policies, and resilience against global challenges will play a major part in engineering the future of international education

Keywords: PISA performance; Global education disparities; Educational equity; Teacher training; Bridging education gaps; Future of education

1. Introduction

A great global benchmark in education, one of the most famous and influential, is the Programme for International Student Assessment (PISA) [6]. The Organisation for Economic Co-operation and Development (OECD) conducts PISA every three years and assesses 15-year-olds in over 80 participating countries based on their knowledge and skills. The assessment focuses on three core domains: measuring what students know in reading, mathematics, and science and how well students can put what they know to work in real-life contexts [16]. PISA provides comparable data for policymakers, educators, and researchers to compare their education systems with other countries and find their weaknesses and strengths.

Over the past 12 years, PISA has generated a recurring insight that there is a large and persistent gap in performance between regions, countries, and socioeconomic groups [3]. Although most nations have experienced some improvement since PISA began, a few, especially in East Asia and Northern Europe, stand out and have essentially defined academic excellence as seen by the PISA rankings. On the other hand, accessing higher quality is burdened by many developing countries and economically disadvantaged regions, and it remains challenging to reach basic proficiency levels. These are not just statistical gaps; they are gaps in opportunities that may seriously restrain young people's futures and cycles of poverty [1].

This review analyzes this global performance gap in detail, investigating what causes it and suggesting ways to close it. It is vital to address these disparities—both because education rankings are associated with social equity and economic growth [11] and because, in doing so, we can stimulate growth as well [2]. If we ensure all people have quality education,

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we can empower people and communities to thrive in a fast, globalizing, competitive world. Much is at stake, and solutions that solve the problem demand bold, collaborative efforts.

2. Understanding PISA: global benchmark in education

The internationally recognized evaluation tool for education systems in participating countries is the Programme for International Student Assessment (PISA) [6]. PISA was initially developed in 2000 by the Organisation for Economic Co-operation and Development (OECD) to test the skills and knowledge of 15-year-old students in situations where school learning must be applied to real-life scenarios. However, this sets PISA apart from traditional academic assessments, in which students are traditionally encouraged to memorize answers without thinking practically to solve problems.

The assessment primarily evaluates three domains: reading, mathematics, and science. It defines reading literacy as a student's ability to understand, interpret, and critically engage with written texts. Can we measure Mathematical Literacy? Mathematical literacy assesses the ability to use mathematics in realistic contexts, like analyzing data or solving problems in everyday situations [29]. Scientific literacy 'involves understanding scientific principles, facts, and processes and applying such knowledge to modern life [4]. In each PISA cycle, one of these domains is spotlighted, giving in-depth insights into how good and bad countries are doing in this area.

One of PISA's major features is its global reach. The assessment serves as a comprehensive comparison of educational outcomes across some 80 countries and economies. This wide participation allows policymakers and educators to understand how their systems measure up internationally and to identify best practices for improvement. High-performing countries like Singapore, Finland, and China often serve as benchmarks, while nations with lower scores use the data to drive reforms.

PISA has a practical focus, which makes it a valuable source for setting education policy. The fact that PISA can highlight how well students can take their knowledge to new challenges offers governments actionable insights to improve the quality of education [5]. The initiative urges nations to tackle snags, like what to teach, how to prepare, where to put the money, and the preparation of teachers.

But PISA has its detractors. Its focus on rankings may encourage countries to doctor up results rather than lasting systemic change. The standardized assessment approach may not measure all the cultural and economic differences affecting student performance. Nevertheless, PISA remains an essential device for grasping and going for. This is why global academic disparities and a manganous for making the learning environments global are more similar and efficient.

3. The current state of global PISA scores

The results of recent PISA cycles reveal a clear yet concerning picture of global educational disparities [6]. While some nations have consistently excelled, others lag far behind, reflecting broader issues of inequality and uneven access to resources [9].

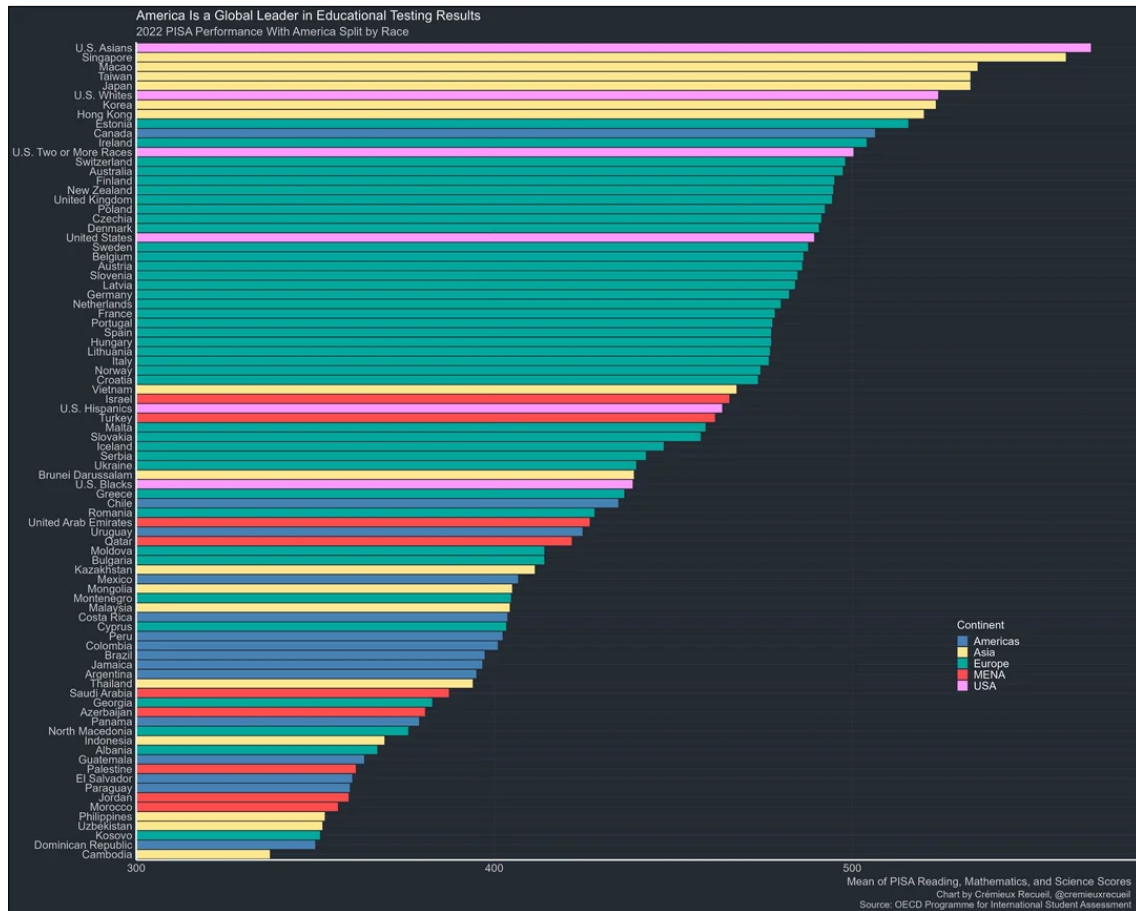
High-performing regions such as East Asia and Scandinavia dominate the rankings. In the three domains of reading, mathematics, and science, countries such as Singapore, China (especially Shanghai and Beijing), and South Korea are the frequent leaders [3]. Part of it is that they focused very strongly on education, had rigorous curricula, and had a culture that put academic achievement high. In parallel, countries belonging to the Nordic countries, such as Finland and Estonia, have high scores thanks to their policies focused on equity, student well-being, and innovative teaching practices.

In contrast, lower-performing regions face persistent challenges. Still, many countries in Sub-Saharan Africa and some in Latin America and Southeast Asia continue to fall below the world average. In many cases, these regions are resource-constrained and need more teacher shortages and infrastructural issues that constrain how to deliver quality education adequately. For example, Brazil and Mexico have progressed in accessing education, but the PISA score indicates that student outcomes still have a long way to go [6].

Global trends also shed light on specific areas of concern. Socioeconomic disparities are the dominant factor, with wealthier nations and better-off student populations continually outperforming their prejudiced counterparts [8]. Other than that, urban students usually outperform rural ones due to a biased supply of resources and opportunities.

Gender gaps are another notable trend. In most countries, girls outperform boys in reading, but boys tend to score slightly better in mathematics [7]. These differences underscore the influence of societal expectations and gender norms on academic performance.

While some regions demonstrate remarkable progress, the global PISA landscape underscores the pressing need for targeted interventions to close performance gaps and ensure a more equitable future in education.



Source: <https://www.oecd.org/en/about/programmes/PISA.html>

Figure 1 PISA 2022 results

4. Factors influencing PISA performance

Several interconnected factors contribute to the wide disparities in PISA performance across countries. The quality of education systems worldwide is influenced by social, economic, cultural, and policy-driven contexts that directly impact these.

Socioeconomic disparity is one of the most important factors. Inevitably, students from (1) wealthier families generally have more resources (2), e.g., access to private tutors, technology, and well-funded schools. On the other hand, disadvantaged students are more likely to be restricted by under-resourced schools, a lack of learning materials, and limited access to extracurricular enrichment [9]. In developing regions especially, this poverty continues to prevent access to education.

Policies and curriculum quality within education also count. For example, high-performing countries like Finland or Singapore designed curricula focusing on critical thinking, creativity, and adaptability. Such lower-performing countries will be facing obsolete or too strict curricula that do not match the needs of a changing world [10].

PISA outcomes are determined by another important factor: teacher quality. Putting money into teacher training and professional development yields better PISA results in the countries involved. For instance, Finland follows up on its success by heavily recruiting and employing highly qualified educators. In contrast, nations facing teacher shortages or employing underqualified staff often need help to achieve high scores [11].

Access to resources and technology further widens the performance gap. Students in wealthier regions have a huge advantage at the schools since they are more likely to have modern facilities, internet connectivity, and teaching aids. Many schools in low-income countries do not have the basic infrastructure, never mind access to cutting-edge educational tools [12].

Cultural attitudes toward education also influence performance. In East Asian countries, education is deeply ingrained as a societal value, leading to high parental involvement and student motivation. This contrasts with regions where education may not be prioritized due to economic pressures or cultural norms [13].

Finally, the use of resources is determined by governance and policy implementation. Corruption, mismanagement, and lack of accountability in resource-rich nations can limit educational advancement. Addressing these factors is something that governments and stakeholders can do to narrow the global PISA performance gap meaningfully [14].

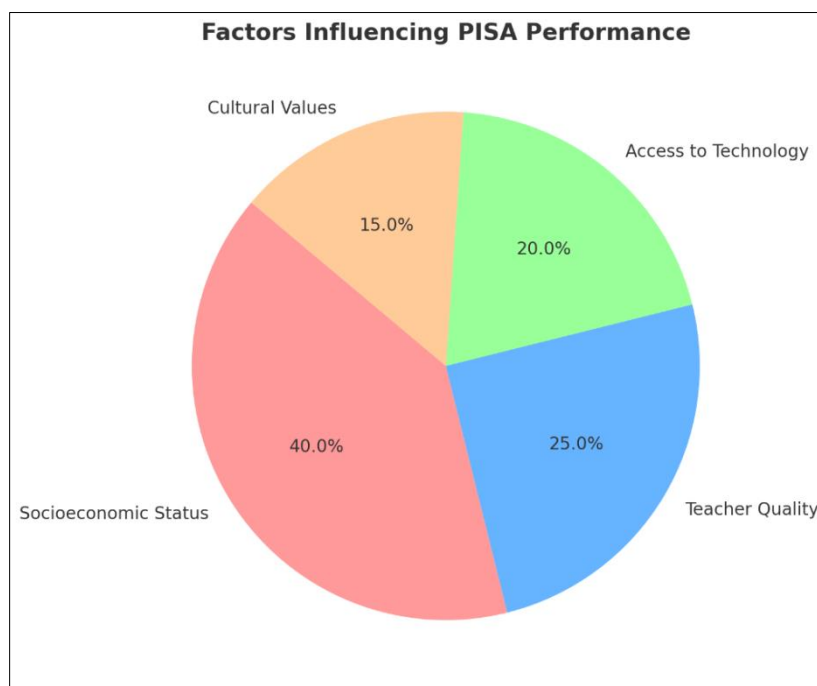


Figure 2 Factors Influencing PISA Performance

5. Regional analysis of PISA gaps

Global PISA results highlight stark regional differences in educational performance. Each region's cultural values, government priorities, and socioeconomic conditions define each region's unique strengths and challenges. To address performance gaps and create more equitable education systems worldwide, we first need to understand these dynamics.

5.1. Asia: Dominance in Global Rankings

East Asian countries consistently top PISA rankings by a considerable margin. Some nations, for instance, Singapore, China, Japan, and South Korea, are well known for reading, mathematics, and science, with scores above the OECD average [6].

5.1.1. Why East Asian Countries Excel

The cultural and social fabric of East Asian countries naturally places a strong emphasis on academics, which is the reason for their international dominance. The education system is understood as a point of social mobility, causing

students, parents, and teachers to focus on academics. High parental expectations and hard work at after-school tutoring make it just the right performance [15].

5.1.2. Culture in Education and Values

In these countries, the educational system focuses on discipline, work, and mastery of the basic subjects. High value is placed on perseverance and excellence; teachers are well-valued, and good teachers are easily attracted to the profession. In addition, there is a great deal of focus on developing problem-solving skills, which ties directly to PISA's assessment requirements.

5.1.3. Governmental Investments in Education

East Asia governments invest much in education with quality schools, teacher training, and modern learning technologies readily available. For example, Singapore's education system takes a two-pronged approach to learning, ensuring that traditional learning methods are not forgotten and that modern pedagogical methods are taught to students [16]. Similarly, improvements in PISA performance are attributable to China's emphasis on education in rural areas

While they are successful, the East Asian education systems are criticized for promoting too much stress for their students while not encouraging much creativity. However, they still invest strategically and are committed to certain cultural priorities.

5.2. Europe: A Mixed Bag of Results

In PISA, Europe is a mixed picture, with some countries performing well and some needing help to keep up. Finland, Sweden, and Norway are typical Scandinavian nations that top the list, while Greece, Italy, and Portugal are among Southern European countries that do poorly [4].

5.2.1. High Scores in Scandinavia

The Scandinavian countries have a reputation for having enlightened, student-centered education systems. In particular, Finland is unusual for its forward-thinking on learning by confronting individualized learning, little homework, and teacher autonomy. It emphasizes social equality, ensuring all students of all socioeconomic backgrounds have access to quality education.

Another top performer has proved to be Estonia, a country that smoothly integrates technology with a thorough curriculum centered on problem-solving and innovation [9].

5.2.2. Challenges in Southern Europe

Many southern European countries need help with high dropout rates, underfunded schools, and youth unemployment. These challenges have been exacerbated by the economic instability in countries such as Greece, making long-term educational reforms difficult [15].

5.2.3. Role of Social Equality in Education

One key factor in Europe's educational success is its commitment to social equality [28]. Countries with strong welfare systems, such as Sweden and Denmark, reduce disparities by providing free education, subsidized meals, and extensive support for struggling students [11]. This contrasts sharply with nations where socioeconomic divides limit access to quality education, resulting in lower PISA scores.

5.3. The Americas: Bridging a Vast Divide

PISA performance disparities in the Americas are striking, from consistently high rankings for Canada to dismal performance in reaching average proficiency levels in Latin America.

5.3.1. The USA's Mediocre Performance Relative to Spending

The USA spends more on education than any other country in the world, yet its performance on PISA is average. These mediocre results have multiple structural causes, including unequal funding sources among school districts, overemphasis on standardized testing, and socioeconomic disparities [27]. Top-tier schools and wealthy districts do well, but hundreds of poor areas must catch up.

5.3.2. *The Contrast between Canada, the US, and Latin America*

Canada is among the high performers, with scores above the OECD average. The robust educational framework emphasizes equity, multicultural inclusivity, and well-trained educators [8].

Because Brazil, Mexico, and Argentina are high-poverty countries, they need more teachers, and their schools need to be more resourced. While the government has successfully extended access to education, quality remains a concern, with PISA scores showing the issue [5].

Within the Americas, stark contrast reveals the need for specific policies regarding funding disparities, teacher quality, and resource access.

5.4. Africa: Struggling to Compete

African countries face the greatest challenges in competing on a global educational stage. Limited participation in PISA highlights systemic issues, as only a handful of African nations have the infrastructure and resources to participate in the assessment [6].

5.4.1. *Problems in African Countries*

Across Africa, where education systems too often contend with severe resource constraints such as overcrowded classrooms and a basic lack of textbooks, this kind of initiative is proving to be a model in its own right, making good use of both inside and outside the classroom [11]. They disproportionately affect the rural areas because there aren't enough qualified teachers and schools in rural areas [14]. From political instability to poverty to cultural factors, progress is nearly impossible to make on a consistent and high-quality education system.

5.4.2. *International Aid and Intervention's Role*

Aids in education in Africa are provided by international organizations such as UNESCO [18], UNICEF, the World Bank, and many others. Improving literacy and numeracy rates and policy initiatives, including building schools, training teachers, and supplying technological tools, have had their promise [12]. Yet, long-term progress will require systemic reform and more investment at the national government level.

This is yet another example of why we cannot allow educational equity to be a global idea but a local action. These challenges are addressed by combining international support, innovative solutions, and sustainable policy in line with the local context.

6. How to bridge the gaps: key strategies

Despite these improvements, global disparities in PISA performance tell us that national and international efforts are needed [22] to make our education system more equitable. Multifaceted strategies are required to fill these gaps: early interventions, teacher development, technological integration, and policy reform.

6.1. Early Childhood Education: The Need for Investment

Research has proven that quality early childhood education leads to long-term academic success [26]. Finland and Estonia are among the countries that devote much more time to pre-primary education and consistently get higher PISA scores. Early interventions build a bridge to diminish socioeconomic disparities by offering disadvantaged children chances to acquire basic education and cognitive development. Opening up access to affordable early education programs [20] and guaranteeing their quality can lead to dramatic improvements in outcomes in regions performing lower.

6.2. Teachers shortages and teacher training.

Most of the time, any education system is supported by teachers. Countries with excellent performance spend a lot on teacher recruitment, training, and professional development of teachers [10]. For instance, Finland requires all teachers to have master's degrees and keeps teachers up to date in their field in subsequent years. Adopting similar practices to improve teacher qualifications, attract talented and competitive experts, and incentivize teachers to work in struggling areas will help such regions. Teachers are trained to put in place standards, teachers are taken care of so the children are well attended to, and they perform better, strengthening student performance and involvement.

6.3. Integrating Technology for Equal Access

Technology can act as a revolutionary force in the evening of the education playing field. Students in remote or underprivileged areas won't have easy access to quality resources, but that possibility can be made available through digital tools and e-learning platforms. Kenya's Digital Literacy Programme are initiatives that show how technology can mitigate infrastructure challenges [17]. However, technology must be integrated with investments in internet access, devices, and teacher training for its potential to be fully capitalized.

6.4. Educational Equity Policies

Systemic inequalities are only solved with equity-focused policies. When governments want to improve our education system, they can provide targeted funding for underperforming schools, subsidized meals, and financial aid for low-income families. Canada and Sweden have reduced performance gaps by promoting equitable resource access [6]. Policy reforms should also deal with the rural-urban divide; everybody should get the needed support to accomplish this.

Table 1 Recommendation for Bridging Global Education Gaps

Strategy	Key Action Items	Expected Outcome
Early Childhood Education	Universal access, quality standards	Better foundational skills
Teacher Training and Recruitment	Higher salaries, rural incentives, ongoing support	Improved student engagement
Technology Integration	Infrastructure investment, teacher tech training	Equal access to resources
Equity-Focused Policies	Targeted funding, reduced rural-urban gaps	Narrowed performance disparities

7. Case studies: success stories and lessons learned.

Examining success stories from top-performing countries provides valuable insights for improving educational outcomes worldwide. Finland and Singapore, in particular, offer distinct yet effective approaches to education reform.

7.1. Finland: A Focus on Equality and Innovation.

Finland's education system is well known for pushing for equality and innovation. The Finnish system doesn't have standardized testing until the end of secondary school; instead, it opts for individualized learning and student well-being [23]. Students are taught by highly trained and respected teachers who can design curricula fitting their classrooms. Moreover, the government guarantees appropriate funding for all schools to reduce discrepancies between urban and rural areas. Finland's success proves that a quality-over-quantity approach can pay off.

7.2. Singapore: Making Tradition Modern

Much of the Singapore education system has been balanced between traditional academic rigor and newer pedagogical approaches. PISA is centered on problem-solving, creativity, and adaptability, and the curriculum focuses on these [25]. Further bolstering this effectiveness is rigorous teacher training programs and reinvestment in technology. Singapore's response emphasizes adapting our educational practices to the changing world while retaining high standards.

7.3. Lessons from These Examples for Struggling Regions

Finland and Singapore also stress having well-trained teachers with access to equitable resource distribution and a commitment to innovation. In this way, struggling regions can take cues from these examples and adapt the corresponding strategies [21] to their specific, culturally, and economically distinct situations. For instance, while Singapore's approach may resonate with nations seeking rapid advancement, Finland's model could benefit regions aiming for long-term equity and stability [24].

Table 2 Comparison of Education Policies in High-Performing Nations

Country	Key Policy Highlights	Outcome
Finland	Free, equitable education; minimal testing	Consistently high scores, low stress
Singapore	Rigorous teacher training; tech integration	Top PISA rankings in all domains
Estonia	Tech-enabled learning; student-centric policies	Leading European PISA performer

8. International organizations and their role

International organizations have a vital role in serving the need to bridge global educational gaps, providing funding support, policy guidance, and capacity building.

8.1. OECD's Role in Global Education Reform

PISA is overseen by the OECD, which uses its invaluable data and analysis to help governments understand their strengths and weaknesses. The OECD provides comprehensive reports on what countries achieve and showcases best practices while urging countries to base their policies on solid evidence. Its initiatives — the Education 2030 Framework — seek to prepare learners for a quickly transforming world.

8.2. What Does UNESCO and UNICEF Contribute?

UNESCO and UNICEF devote attention to increasing access to education in deprived and crisis-affected areas [19]. Through UNESCO's Global Education Monitoring Report, progress in achieving universal education goals is tracked, and recommendations are made for policymakers to follow to achieve these goals. In underserved areas, UNICEF funds projects like building schools, training teachers, and procuring learning materials. Their collective work keeps education high on the agenda of development.

International organizations build nations' capacity to work together to close gaps and achieve better outcomes for all students regardless of income level.

9. How cultural context matters in bridging gaps

Recreating high-performing countries' successes is insufficient to bridge global disparities in education. As far as best practices from countries such as Finland or Singapore prove, they must be appropriate for implementation in other parts of the world because of their respective cultural, economic, and societal factors. Cultural sensitivity is essential for meaningful, lasting reforms because local traditions, values, and histories are deeply rooted in education systems.

9.1. Educational Policies Tailored to a Local Culture

There is no one-size-fits-all, and education is never one-fits-all. They will fail if they lack cultural fit with local values and needs, but policies that succeed in one cultural context could also be successful in another. For example, East Asian countries like South Korea and Japan emphasize discipline and collectivism, which align with their cultural priorities. In contrast, Nordic countries prioritize equality and individualized learning, reflecting their strong social welfare ethos. Both approaches are effective within their respective contexts but may yield different results elsewhere.

Tailoring educational reforms to local cultures ensures greater acceptance and effectiveness. For example, in regions where community involvement is necessary – in parts of Africa and Latin America – education policies that involve local leaders and families are successful. As in New Zealand, incorporating the Māori perspective into curricula has helped promote cultural identity and improved educational outcomes.

9.2. The Dangers of a One-Size-Fits-All Approach

Imposing a universal solution underpinning educational disparities can have the reverse effect, especially in defined resource-constrained, diverse regions. For instance, do overly standardized testing systems, in their obsessive quest to ensure that we all score 100 on the math exam, favor rote learning over creativity and critical thinking — skills vital to the 21st century? Implementing policies that work in developed countries with good infrastructure might not be realistic for developing countries that face many constraints, such as a shortage of teachers or a lack of basic facilities.

Ignoring cultural differences can also alienate communities, creating resistance or disengagement. Reforms that don't tackle these bones of discontent will not be successful in areas where education hasn't historically been a priority, for economic reasons, or from historical inequality. Long-term improvements require social needs, values, and resources aligned with policy.

As a matter of course, closing PISA performance gaps requires supporting diversity while being open to innovation. If nations avoid the pitfalls of one-size-fits-all and instead tailor their policies to the needs of the local context, their educational systems will be the kind that allows their students to be successful on their own terms.

10. The future of global education performance

As countries try to meet the demands of the modern world, we are about to see big changes in how countries perceive global education. Technologies are emerging, curricula are evolving, and societal priorities are shifting, affecting how nations view education. While PISA aims to measure students' educational attainment, the performance gaps in the results show that more still needs to be done to ensure all students have equal chances to do well. For the future of global education, countries will need to respond to these changes while tackling entrenched inequalities.

As transformation in education ensues, technology will be the course mediator. Today, digital tools and artificial intelligence are reimagining how much students learn and how much teacher instruction delivers. E-learning platforms and virtual classrooms have already shown the potential to enable students in remote or underserved areas. However, to succeed, these technologies require closing the digital divide, as many countries need help to implement such technologies efficiently due to the infrastructures not being there. Access to internet connectivity and devices will be critical to making technology work in a quest for educational equity.

As the work economy evolves, the education architecture has to focus on skills that will complement the work ecosystem of the 21st century. Traditional academic subjects will likely be taught alongside critical thinking, problem-solving, and adaptability, skills that will be important in the future. The nations, particularly China that integrate these competencies into their education systems proactively will be better able to prepare students for a changing world. Furthermore, global assessments such as PISA may also adapt to these new priorities and, as a result, motivate countries to adopt more innovative approaches to teaching.

This explains a major influence on the future of education in light of global challenges such as climate change, pandemics, and political instability, to mention a few. During the COVID-19 pandemic, the weaknesses of education systems were demonstrated most severely in low-income regions where disruptions were most severe [30]. The systems will need to be built to withstand crises that can interfere with the progress in educational outcomes. Investments in infrastructure, teacher training, and remote learning capabilities will mean that students can continue learning even in difficult circumstances.

Equity will remain at the heart of global educational progress. Socioeconomic disparities, gender inequalities, and rural-urban divides still beset student performance. We need targeted policies to address these inequities: funding disadvantaged schools, (2) access to early childhood education for all, and (3) access to underserved communities. Where access to quality education is equitably offered, performance will improve, and performance gaps will be narrowed.

The driver of future success will be international collaboration. The idea and resource exchange will facilitate organizations like OECD, UNESCO, and UNICEF. Working together, countries can learn from one another's successes and challenges; each nation will innovate and move forward. Global teacher's training programs or teach-share research partnerships will help to create a massively networked, collaborative, supportive community that helps each other.

Global education is full of potential, but it's also challenging. We must change and stay committed to equity and inclusion, but we must change. Focusing on technology, forward-looking curricula, and collaborative efforts, we can guarantee that education will become a great instrument for joining gaps and making students around the globe. But it's a hard path, and bold actions will be needed to make it so, but the dividends will last for generations.

11. Conclusion

The Programme for International Student Assessment (PISA) has become the world's most important education indicator. Their findings show what high-performing countries do right and reinforce how millions of students are left

behind. It is not just about improving test scores – this is a world mandate to guarantee that every child, regardless of their socioeconomic situation or where they are in the globe, is equipped with a good education.

These inequalities need to be addressed in full. So, how do you level the playing field? How do we invest in early childhood education, how do we improve teacher training, how do we integrate technology, and how do we implement the policies that make equity a possibility? Appreciating the relevance and sustainability of reforms requires additionally recognizing the importance of the cultural context. We need to stop looking for universal solutions and go for tailored ones.

The lessons we can learn from their success stories include how Finland focused on equality, how Singapore admired innovation, and so on. But the future of global education isn't just about individual effort; it's about an international effort. The OECD, UNESCO, and Unicef are crucial in making these collaborations happen since countries can learn from and share resources and strategies for the same goal.

Education is the backbone of social and economic development and plays a leading role outside the classroom. Bridging the gaps outlined in PISA is an urgent boldness of policies and a collective commitment from governments, educators, and international organizations. After solving these issues, each student will get a chance to succeed and make a difference in a better future.

References

- [1] Muller, C., and De Vasconcelos Aguiar, J. P. (2023, August 31). What is the digital divide? - internet society. Internet Society. <https://www.internetsociety.org/blog/2022/03/what-is-the-digital-divide/>
- [2] Bahena, R., Kilag, O. K., Andrin, G., Diano Jr, F., Unabia, R., and Valle, J. (2024). From Method to Equity: Rethinking Mathematics Assessment Policies in Education. *Excellencia: International Multi-disciplinary Journal of Education* (2994-9521),2(1), 121-132.
- [3] Hanushek, E. A., and Woessmann, L. (2023). *The knowledge capital of nations: Education and the economics of growth*. MIT press.
- [4] Pulkkinen, J., and Rautopuro, J. (2022). The correspondence between PISA performance and school achievement in Finland. *International Journal of Educational Research*, 114, Article 102000. <https://doi.org/10.1016/j.ijer.2022.102000>
- [5] Wisniewski, B., Röhl, S., and Fauth, B. (2022). The perception problem: A comparison of teachers' self-perceptions and students' perceptions of instructional quality. *Learning Environments Research*, 25, 775–802. <https://doi.org/10.1007/s10984-021-09397-4>
- [6] Zaim, M., Refnaldi, R., Zainil, Y., and Ramadhani, F. (2021). PISA reading literacy assessment and senior high school reading literacy assessments: How do they differ? *International Journal of Research in Counseling and Education*, 5(1), 72-78. <https://doi.org/10.24036/00466za0002>
- [7] Bonfadelli H. (2002). The Internet and knowledge gaps: A theoretical and empirical investigation. *European Journal of Communication*, 17(1), 65–84.
- [8] Liu J. (2020a). Digital divide and education equity: Empirical investigation using PISA 2018 B-S-Z-J. *Journal of National Academy of Education Administration*, 273(9), 35–43.
- [9] Hoxby, C. M. (2020). The effects of class size on student achievement: New evidence from population variation. *Quarterly Journal of Economics*, 135(4), 1239–1285.
- [10] Kelly, E. L. (2022). Flexible work arrangements and teacher well-being. *Journal of Educational Administration*, 60(6), 831–844.
- [11] Delprato, M., and Antequera, G. (2021). School efficiency in low and middle income countries: An analysis based on PISA for development learning survey. *International Journal of Educational Development*, 80, 102296.
- [12] Center for Teaching Innovation. (2022). Identifying and addressing learning gaps. Retrieved from <https://teaching.cornell.edu/identifying-addressing-learninggaps>
- [13] Gadias, T. et al. (2020). The Role of the Teacher in the Implementation of a School-Based Intervention on the Physical Activity Practice of Children. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7579276/>

- [14] UNESCO. (n.d.). UnescoPhysicalDocument. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000373718>
- [15] UNICEF. (2019). Education in emergencies: A global overview. UNICEF. <https://www.unicef.org/reports/education-emergencies-global-overview>
- [16] PISA 2022 Assessment and Analytical Framework. (2023, August 31). OECD. https://www.oecd.org/en/publications/PISA-2022-assessment-and-analytical-framework_dfe0bf9c-en.html
- [17] OECD. (2021). Starting Strong 2021: Key OECD indicators on early childhood education and care. OECD Publishing. <https://doi.org/10.1787/5b1f1c7e-en>
- [18] (2022). Unesco.org. <https://unesdoc.unesco.org/ark:/48223/pf0000379875>
- [19] UNICEF. (2023). The State of the World's Children 2023 | UNICEF. [Www.unicef.org. https://www.unicef.org/reports/state-worlds-children-2023](https://www.unicef.org/reports/state-worlds-children-2023)
- [20] Visnjic Jevtic, Adrijana. (2022). Early childhood education -the path to equality in a world of inequality.
- [21] Saracho, O. N. (2023). Theories of child development and their impact on early childhood education and care. *Early Childhood Education Journal*, 51(1), 15-30.
- [22] Early Childhood Education and Child Development: New Evidence from Ghana, *Children and Youth Services Review*, Volume 108, 2020, 104620, ISSN 0190-7409, <https://doi.org/10.1016/j.childyouth.2019.104620>.
- [23] Hahn, R. A., and Barnett, W. S. (2022). Early Childhood Education: Health, Equity, and Economics. *Annual Review of Public Health*, 44(1), 75–92. <https://doi.org/10.1146/annurev-publhealth-071321-032337>
- [24] Weems, A. (2019, August 1). Impact of Early Childhood Education on Later Academic Achievement. UNT Digital Library. <https://digital.library.unt.edu/ark:/67531/metadc1538681/>
- [25] OECD. (2023, September 12). Review Education Policies - Education GPS - OECD. [Oecd.org; OECD. https://gpseducation.oecd.org/revieweducationpolicies/#](https://gpseducation.oecd.org/revieweducationpolicies/#)
- [26] Friedman-Krauss, Allison and Barnett, William and Garver, Karin and Hodges, Katherine and Weisenfeld, Gg and DiCrecchio, Nicole. (2019). *The State of Preschool Yearbook 2018*.
- [27] Jaiteh, L., Xin, G., and Sidibe, A. (2024). The Effects of Field-of-Education Job Mismatch on the Current Earnings of the Recent Graduates of the University of Gambia. *Advances in Social Sciences Research Journal*, 11(9), 84–99. <https://doi.org/10.14738/assrj.119.17476>
- [28] Early Childhood Education and Care. (n.d.). European Education Area. <https://education.ec.europa.eu/document/early-childhood-education-and-care>
- [29] Education at a Glance 2023. (n.d.). https://www.oecd-ilibrary.org/education/education-at-a-glance-2023_e13bef63-en
- [30] Pattnaik J, Jalongo MR. Early Childhood Education and Care in the Time of COVID-19: Introduction to a Special Issue of *Early Childhood Education Journal*. *Early Child Educ J*. 2021;49(5):757-762. doi: 10.1007/s10643-021-01220-2. Epub 2021 Jun 17. PMID: 34177244; PMCID: PMC8210967.