MAKING TECHNOLOGY WORK FOR EDUCATION TRANSFORMATION GOALS:
A PARTNERSHIP APPROACH FOR ACTION

October 2024

GPE | Transforming Education

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ACKNOWLEDGMENTS

ABBREVIATIONS AND ACRONYMS

AI	Artificial Intelligence
AR/VR	Augmented Reality/Virtual Reality
EdTech	Education Technology
EMIS	Education Management Information System
FMIS	Financial Management Information System
GPE	Global Partnership for Education
ICT	Information and Communications Technology
SDG	Sustainable Development Goal
Tech4Ed	Technology for Education
TMIS	Teacher Management Information System

EXECUTIVE SUMMARY

The potential and importance of Technology for Education (Tech4Ed) became increasingly apparent during the COVID-19 pandemic, when education systems across the world turned to distance learning. Education systems have the critical task to equip learners with the skills they need to succeed in life. The goal of the Global Partnership for Education (GPE) is "to accelerate access, learning outcomes and gender equality through equitable, inclusive and resilient education systems fit for the 21st century."[1] As partner countries are implementing their education priority reforms, technology is seen as one of the key enablers to help accelerate results achievement in education.

This paper proposes a partnership approach to harness technology, with the aim of addressing barriers to transformation within education systems. Section 1 reviews the current state of evidence on the relationship between technology (including artificial intelligence [AI]), education, gender-transformative approaches, skills development and employment. Section 2 builds on existing work of other education partners and identifies five goals for the digital transformation of education, six pillars for countries to prioritize to achieve these education goals, and five key principles that should inform the approach to optimize the impact of technology and AI on education. Section 3 outlines GPE entry points to operationalize proposed approaches of digital transformation in education at the country, regional and global levels.

Implications of Technology and AI for Education

Technology and artificial intelligence hold the promise to support personalized teaching and learning at scale, to improve formative assessments as well as education management and resilience, and to prepare learners for future jobs by building critical skills. However, this requires the adoption of the following at country level:

> A clear vision for the transformation of their education system

> Context-relevant and inclusive strategies for the development of digital solutions and AI tools for education

> Regulatory and collaborative frameworks to leverage and safely scale the positive impact of technology and AI while keeping up with their rapid development pace.

Tech4Ed and Gender-Transformative Approaches

The use of technologies in education has a gendered impact, as with all interventions to improve education access and learning. If gender dynamics are not considered, the use of technology in education carries the risk of heightening existing gender disparities within education. Gender-transformative Tech4Ed interventions should address gender norms and stereotypes, as well as foster safety, empowerment and equal engagement of boys and girls in the design and rollout of digital solutions.

Tech4Ed, Skills and Employment

Technology is rapidly altering the labor market and the demand for skills required to be productive. Amid these transformations, education systems are struggling to equip students with the skills they need to navigate their future. A global review estimated that very few students from low- and lower-middle-income countries have access to digital literacy classes in primary and/ or secondary education. This discrepancy poses risks for future economic dividends, especially considering the increasing demand for digital proficiency in job markets.

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1. GPE, *GPE 2025 Strategic Plan*.

This also calls for governments to design strategies and establish partnerships that prepare education systems to do the following:

> Keep up with the changing demand for skills.

> Focus on human-centered skills that cannot be automated, such as critical and analytical thinking, problem solving, collaborative and adaptability skills, and other socio-emotional skills.

> Enable learners, teachers and education managers to work with technology to improve equitable access and learning outcomes.

Purpose, Pillars and Principles of Digital Transformation in Education

GPE sees great value in the digital transformation of education to address major education challenges and help implement efficiently education priorities. Such digital transformation can be achieved if countries prioritize six critical pillars of digital transformation in education: (1) coordination and leadership, (2) connectivity and infrastructure, (3) content and solutions, (4) cost and sustainability, (5) capacity and culture, and (6) data and evidence.

These pillars should be operationalized in conformity with the following five principles of digital transformation in education when developing digital solutions: (i) purpose-driven in line with relevant education priorities, (ii) led by the needs of country context, (iii) sustainable and scalable, (iv) designed for all, and (v) safe and secure.

Operationalization of Education Digital Transformation at Country, Regional and Global Levels

GPE is committed to supporting partner countries to build system resilience and transform education by mobilizing partnerships and investments, leaving no one behind. GPE's approach consists of engaging all relevant partners within and outside the education sector under the leadership of governments in support of education priority reforms. Through this approach, GPE leverages global, regional and national expertise and resources to enable policy change and build national capacity in areas critical to effective and resilient education systems. GPE also relies on its partnership approach to embrace technology and innovations that have the potential to accelerate the implementation of priority reforms and achieve education outcomes.

The GPE operating model promotes engagement with partner countries to (1) assess barriers to transformation within education systems and their digital readiness, (2) leverage partners' expertise and assets to prioritize evidence-based Tech4Ed policies, (3) apply education digitalization principles within Tech4Ed programming, (4) deploy context-relevant digital solutions, and (5) learn from their implementation approaches and adapt their programming accordingly.

At the regional and global levels, GPE engages with partners to (1) mobilize evidence and exchange knowledge on practices and challenges, (2) advocate for a holistic approach to education digital transformation, and (3) leverage expertise and resources to support partner countries.

INTRODUCTION

An estimated 7 in 10 children in low- and middle-income countries are unable to read a simple text by the age of 10.[2] As education systems face multiple crises, technology is increasingly seen as an enabler for education continuity, particularly for hard-to-reach and vulnerable children. Furthermore, as the world transitions toward a digital economy, new competencies are required to thrive in the labor market. Yet education stakeholders are yet to be empowered to effectively select and deploy technology that could help address barriers to system resilience, education access and learning.

The goal of the Global Partnership for Education (GPE) is "to accelerate access, learning outcomes and gender equality through equitable, inclusive and resilient education systems fit for the 21st century."[3] Identifying innovative approaches to transform education and build resilient systems is a critical part of GPE's mission. The success of GPE's system transformation approach relies on partners working together effectively at the country level. Under the leadership of governments, partners leverage their resources and expertise to collectively (1) diagnose key barriers within the education system that, if addressed, are likely to have a transformative effect on the system to deliver quality education for every child; (2) discuss and agree on a priority reform that has the potential to positively impact the broader education system; and (3) improve service delivery at scale, learn and adapt.

The COVID-19 pandemic has disrupted education for 1.5 billion children and created the urgency to expand the use of technology for education (Tech4Ed). Several GPE partner countries have expressed the need for support to leverage technology as an accelerator to address key challenges faced by their education systems.

Defining Technology for Education

Education technology, or EdTech as it is more commonly known, is the use of information and communications technology (ICT) in education systems. However, GPE prefers the broader, more encompassing notion of *technology for education* (Tech4Ed). GPE conceptualizes Tech4Ed as the responsible, informed and strategic deployment and use of technologies and artificial intelligence (AI)[4] tools by actors of the education ecosystem (learners, parents/guardians, teachers, school leaders and education ministry personnel, among others) to improve equitable and inclusive access to education, positively transform teaching and learning, prepare children and young people to thrive in a digital world, and strengthen the resilience and efficient management of education systems. Within GPE's Tech4Ed framing, technology and AI should be inclusive, contextually relevant and people centered. GPE's support to education systems involves a mixed approach that combines low-, medium- and high-tech solutions to deliver education services. Sometimes the appropriate Tech4Ed in a particular context may be a combination of ways of learning and low-tech solutions, also known as "multimodal teaching and learning."

Purpose of This Paper

The need for a partnership approach to operationalize Tech4Ed has never been more urgent. Building on existing work[5] in this area, this position paper proposes a partnership approach that identifies opportunities within the technology and education ecosystem that can be leveraged to address barriers to transformation within education systems. The paper, underpinned by five key principles of technology adoption and deployment,

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2. World Bank Group et al., *The State of Global Learning Poverty*.
3. GPE, *GPE 2025 Strategic Plan*.
4. "[AI] is the science and engineering of making intelligent machines, especially intelligent computer programs." McCarthy, "What is artificial intelligence?", 2.
5. Initiatives like the EdTech Hub, GPE Knowledge and Innovation Exchange (KIX) has generated evidence. The Digital Transformation Collaborative (DTC), a tech-focused subgroup of Global Education Coalition partners has also supported the development of a global EdTech framework.

proposes a scope of use of technology in education and adapts the global EdTech framework's pillars[6] (see figure 1) to guide GPE's engagement at the country, regional and global levels. It also highlights opportunities for promoting the role of education to ensure young people transition smoothly into the digital economy.

This paper is therefore a pragmatic guide for engagement and collaborative efforts at the country, regional and global levels. Its target audience is public, private and philanthropic partners interested in transforming education systems in low- and lower-middle-income countries. Specifically, the paper adapts and aims to amplify the global EdTech framework[7] (see section 2.1) and is centered around the following:

› Specific education goals that technology solutions are supposed to help achieve at the country level and include (see annex 1):
   • Equitable and inclusive education access
   • Personalized teaching and learning
   • Digital skills development
   • Education system resilience
   • Education system effectiveness

› Relevant principles to mitigate risks associated with the integration of technology in education when developing digital solutions (see section 2.2):
   • Purpose-driven in line with relevant education priorities
   • Led by the needs of country context
   • Sustainable and scalable
   • Designed for all
   • Safe and secure

Figure 1. Global EdTech framework pillars of digital transformation in education
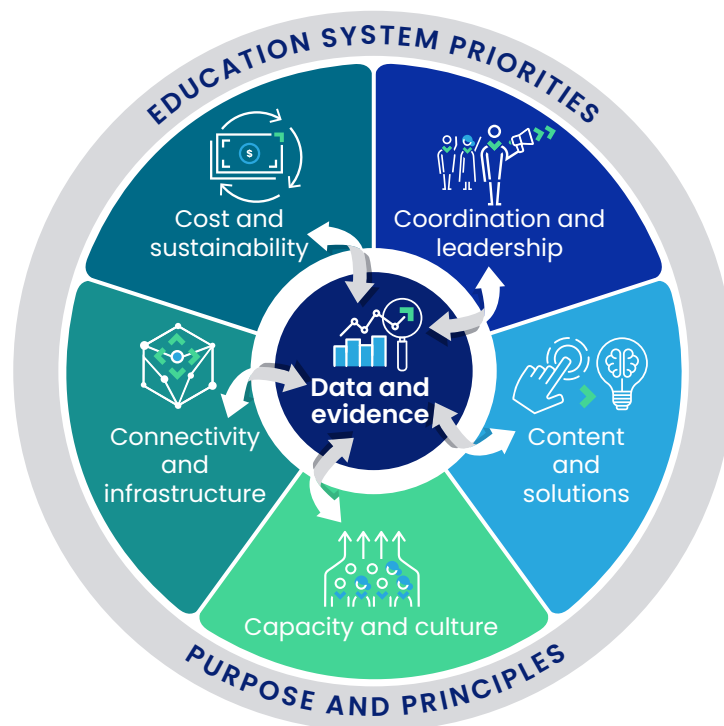
Source: Reproduced based on Global EdTech Framework in UNESCO, ITU, UNICEF, and GPE, *Six pillars for the digital transformation of education*, 7.

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6. The global EdTech framework's pillars are: (1) coordination and leadership, (2) connectivity and infrastructure, (3) cost and sustainability, (4) capacity and culture, (5) content and solutions, and (6) data and evidence.
7. UNESCO, ITU, UNICEF, and GPE, *Six pillars for the digital transformation of education*.

Figure 2 illustrates GPE's engagement at the country, regional and global levels to support digital transformation in education.

Figure 2. GPE entry points at country, regional and global levels

Country-level entry points				Global- and regional-level entry points	
Assess education system barriers to transformation and digital readiness	Leverage partner expertise and resources to prioritize evidence-based Tech4Ed policies	Apply education digitalization principles within Tech4Ed programming	Agile deployment, continuous learning and course correction	Evidence mobilization, learning exchange and advocacy	Leveraging global and regional expertise and financing for countries

SECTION 1. TOWARD THE DIGITAL TRANSFORMATION OF EDUCATION

1.1. Importance of Technology in Education in the Global Context

The Education 2030 Framework for Action includes technology among the key enablers to help achieve Sustainable Development Goal (SDG) 4.[8] It also recommends that governments ensure children and young people acquire the skills they need to thrive in school and at work, and to live in a digital economy, with the support of well-trained teachers. In 2019, through the Beijing Consensus on Artificial Intelligence and Education, education stakeholders acknowledged the potential of AI to help improve education systems and reinforce personalized teaching and learning.[9] More recently, the 2023 Global Education Monitoring Report (GEMR) considers technology as an education input, a means of education delivery, a skill, as well as a tool for education planning and policy making. In parallel, while private sector actors[10] are increasingly willing to invest more in Tech4Ed, digital innovation in education remains largely underfunded: the sector benefited from less than 4 percent of overall expenditures on technology.[11] Education systems are left grappling with the tasks, on one hand, to prepare children and young people to thrive in the digital era, and on the other hand, to manage the integration of technology in education in a way that maximizes learning outcomes and system efficiency.

1.2. Challenges Linking Education and Technology

Research on what works in Tech4Ed is slowly growing, yet this evidence base is not fully utilized. A recent study found that adoption of digital solutions by policy makers depends mainly on the credibility of who is putting forward the solutions, as well as how it impacts governments' visibility.[12] Significant evidence gaps remain on the effectiveness of and best implementation strategies for technological solutions for educational purposes, whether teaching, learning or education management. As a result, many interventions are not designed to address the learning challenges of children in classrooms or with the users in mind; fail to set clear, context-specific goals; and are being scaled up without sufficient evidence.[13]

Connectivity Challenges

Unequal access to internet connectivity is widening existing inequities, including for girls and other disad-

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8. The Incheon Declaration and Framework for action can be found here: https://uis.unesco.org/sites/default/files/documents/education-2030-incheon-framework-for-action-implementation-of-sdg4-2016-en_2.pdf.
9. UNESCO, *Beijing Consensus on Artificial Intelligence and Education*.
10. In 2023, the EdTech market size was estimated at US$222.4 billion according to iMARC.
11. Holon IQ, "Education Technology in 10 Charts".
12. Olsen, *Government Decisionmaking on Education in Low- and Middle-Income Countries*.
13. UNICEF and ITU, *How Many Children and Young People Have Internet at Home?*

vantaged groups. Two-thirds of the world's school-age children do not have internet connections in their homes.[14] Access to internet in schools remains limited as well. Globally, 40 percent of primary, 50 percent of lower-secondary and 65 percent of upper-secondary schools are connected to the internet, while the proportion of schools with computers for teaching purposes is 47 percent in primary, 62 percent in lower-secondary and 76 percent in upper-secondary schools in 2020.[15] Low- and middle-income countries therefore face significant challenges in terms of resources, digital infrastructure, limited access to ICT equipment and low electricity coverage to use technology, particularly in rural areas. Countries do not often adopt the most appropriate and context-relevant technology to overcome their connectivity challenges. Where governments have been able to simultaneously deploy low- and high-tech solutions,[16] more opportunities have been created to reach more learners than compared with solutions that rely only on the use of internet connectivity and digital technologies.[17]

Lack of Government Leadership and Expertise in Tech4Ed

Education ministries do not always lead on EdTech.[18] When they do lead, their collaboration and coordination with ministries of ICT and other relevant stakeholders could be further strengthened; therefore, education plans and national digital transformation policies tend to be disconnected.[19] Only 13 percent of countries[20] have policies on equitable access to technology in schools.[21] Furthermore, reviews conducted in 2022 found that

one-third of the 24 publicly available AI national strategies integrated AI in teaching and learning, while 11 out of 51 governments had developed and implemented AI curricula.[22] Enhancing AI adoption in education requires appropriate regulation, specialized skills, as well as adjustments in teacher professional development programs—two-thirds of teachers feel they do not have the skills to design and facilitate digital learning.[23]

Low-Quality Content

Using digital learning solutions with quality education content that allows personalization and adapts to the learning level of children has been proven to be cost-effective.[24] While it is imperative for countries to consistently assess the quality of digital content and adopt relevant pedagogies, it is proven difficult because of the absence of quality assurance frameworks and the capacity of education stakeholders to do so.[25] In addition, without paying attention to quality content and pedagogies, the provision of hardware (computers or tablets) does not support positive outcomes for learners.[26] Even in well-resourced countries like the United States, where in some cases 90 percent of grant funding directed at EdTech goes to hardware purchases for schools, little evidence shows that this approach has been effective.[27]

Barriers to Use of Technology for System Efficiency

Digital technology can successfully help improve efficiency through the development of data-driven education systems. Digital platforms such as the education

14.   UNICEF and ITU, *How Many Children and Young People Have Internet at Home?*
15.   Global Education Monitoring Report Team, *Technology in Education*.
16.   Low-tech solutions refer to approaches that prioritize technologies that are already available in the communities. They are characterized by their simplicity, durability and their accessibility by the most marginalized groups. The low-tech technologies include mobile phones, radio and television.
17.   Muñoz-Najar et al., *Remote Learning during COVID-19*.
18.   Only 58 percent of education ministries take the lead on education technology governance (Global Education Monitoring Report Team, *Technology in Education*).
19.   Global Education Monitoring Report Team, *Technology in Education*.
20.   The refers to countries included in PEER 2023 profiling: a mix of high-, middle- and low-income countries. Find more information on the PEER website: https://education-profiles.org/themes/~technology.
21.   Global Education Monitoring Report Team, *Technology in Education*.
22.   Global Education Monitoring Report Team, *Technology in Education*; Yano et al., *Modernizing Education Management with EMIS*.
23.   UNICEF, "Putting the Learning Back in Remote Learning".
24.   GEEAP, *Cost-Effective Approaches to Improve Global Learning*.
25.   Global Education Monitoring Report Team, *Technology in Education*.
26.   Rodriguez-Segura and Crawfurd, "What Works in Edtech?".
27.   GEEAP, *Cost-Effective Approaches to Improve Global Learning*.

management information system (EMIS) integrated with the teacher management information system (TMIS), the financial management information system (FMIS), the national identification systems and geospatial data systems enable education systems to generate timely data for planning, efficient resources management and education outcomes monitoring, among other opportunities. However, countries that wish to make ongoing use of information systems face challenges related to the absence of policy frameworks for their governance, fragmented and disconnected data systems, as well as weak technical capacity of human resources and cost inefficiency.[28] Cost sustainability poses another challenge for national budgets, particularly for low- and lower-middle-income countries, as their digital transformation could add as much as 50 percent to their current financing gap for achieving national SDG 4 targets.[29]

1.3. Understanding the Implications of Emerging Technologies in Education

Emerging technologies such as AI, robotics, augmented reality/virtual reality (AR/VR) and blockchain[30] are being considered among the potential enablers in the process of strengthening education systems to improve inclusive access and learning.

AI has shown great potential that it can facilitate personalized experiences at scale tailored to students' and teachers' needs, support adaptive learning and assessment, improve education management and prepare learners for future job markets by building critical skills.[31] However, less than a quarter of low- and middle-income countries have set their vision to leverage, regulate and mitigate the risks associated to AI.[32] Without a

clear vision, context-specific strategies and a regulatory framework, countries are being outpaced by the rapid development of AI tools that are not necessarily fit to address the education challenges they are facing in terms of equity and inclusion, safe and effective teaching and learning, as well as efficient governance.

A mapping conducted by UNESCO in 2021 found that very few low- and middle-income countries have reported the availability of an existing AI curriculum or ongoing development process of a curriculum that integrates AI.[33] Countries' strategies need therefore to ensure the current AI models go beyond knowledge content generation and cover aspects related to child-centered pedagogy, AI literacy, and teacher-student interaction as well as consider country contexts and cultural identity. Scarcity of evidence about AI use in education owing to its relatively nascent availability to and use by the general public calls for the adoption of measures related to accountability, fairness, transparency, well-being, privacy, security and safety.

Robotics technology offers various possibilities within education for enhancing the learning experience. It has been found useful at all levels of education and for all students, particularly those with special needs.[34] It has been used in classroom environments to promote active engagement, improve social interactions and collaboration among students, develop problem-solving and critical-thinking skills, and support tutoring tasks. However, similarly to other technologies, a lack of financial resources to acquire robotic equipment and capacity to integrate robotics into curricula and lessons plans are among some of the major challenges for its wide adoption within education systems.

VR and AR provide teachers and students with immersive, interactive and engaging tools to grasp abstract

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28. Global Education Monitoring Report Team, *Technology in Education*; Yano et al., *Modernizing Education Management with EMIS*.
29. Global Education Monitoring Report Team, *Technology in Education*.
30. Blockchain is a shared and decentralized technology used to record and securely store digital transactions such as educational records and credentials as well as contracts.
31. Ma et al., "Intelligent Tutoring Systems and Learning Outcomes"; OECD, *OECD Digital Education Outlook 2023*; WEF, *Shaping the Future of Learning*.
32. These risks relate to ethics, disparities, potential errors and algorithmic bias, use of AI tools for inappropriate purpose, and misuse of confidential and personal information (Oxford Insights, *Government AI Readiness Index*).
33. These countries are Algeria, Jordan, Syria and India.
34. Screpanti, Miotti, and Monteriù, "Robotics in Education".

concepts as well as gain hands-on experience to ultimately improve learning.[35] VR and AR technologies also offer solutions to support children with cognitive or learning disabilities such as dyslexia, autism spectrum disorder (ASD) and attention-deficit hyperactivity disorder (ADHD).[36] For example, promising AR tools can enhance textbooks and other learning materials to adapt to the needs of students with learning disabilities. The benefits of VR and AR also include the ability to have experiences that might be inaccessible to schools, impractical or unsafe in real life.[37] For example, these experiences include giving access to virtual science laboratories, encountering a new culture, and learning about the consequences of climate change. Blockchain, despite its infancy, can become an essential technology in streamlining the verification process of educational credentials and contracts' management.

Policy makers within the education sector, while embracing these advanced technologies for the purpose of transforming education systems and preparing citizens to thrive in a digital world, should have a critical view of the risks, challenges, as well as social and cost implications. Teachers and learners must remain at the center of the transformation process of education.

1.4. Tech4Ed and Gender-Transformative Approaches

The principles behind a gender transformative approach in a technology-based education intervention are similar to those of other approaches aiming to advance gender equality in and through education. It is important to tackle the causes of gender-based inequalities and work to transform harmful gender roles, norms and power imbalances.[38] Furthermore, a trans-

formative approach requires engagement with key stakeholders such as women, youth and civil society organizations.[39]

If gender dynamics are not considered, the use of technology in education carries the risk of heightening existing gender disparities within education. This could occur if the deployed approaches explicitly reinforce existing gender stereotypes and divisions or result in unintended differences in program incidence between boys and girls. For example, an EdTech intervention on numeracy that does not incorporate gender dynamics ends up benefiting mainly boys in a context where they were already outperforming girls.[40] These risks, and mitigation strategies, must be a consideration in the integration of technology in education.

Initial evidence suggests gender norms and safety concerns are some of the reasons behind different levels of access to devices and the internet. Qualitative studies have found that gender norms related to notions of adolescent girls' purity and subservience prior to marriage serve as barriers to adolescent girls' use and ownership of phones.[41] Other studies suggest that women and girls face online violence, such as physical threats, cyberstalking and sexual harassment, more often than men and boys.[42] The risk of violence can trigger adverse reactions to technology by concerned parents and lead girls to fear or mistrust technology.[43]

Some studies suggest that girls seem to perform as well as boys when using technology in education, and potentially benefit more in terms of empowerment. Studies in Bangladesh showed audio lessons helped overcome girls' learning gaps in language and numeracy during the COVID-19 pandemic.[44] In a study in Pakistan, gender was not found to be a factor in determining

35. Scavarelli, Arya, and Teather, "Virtual Reality and Augmented Reality in Social Learning Spaces".
36. Baragash et al., "Augmented Reality and Functional Skills Acquisition among Individuals with Special Needs".
37. Siegle et al., "Immersive Learning Environments at Scale".
38. Samuels et al., "How to Design EdTech Programmes That Lead to Gender-Transformative Change".
39. GPE, *Going Further Together*.
40. Webb et al., *Girls' Education and EdTech*.
41. UNICEF, *Bridging the Gender Digital Divide*.
42. UN Women, *Online and ICT Facilitated Violence against Women and Girls during COVID-19*.
43. Webb et al., *Girls' Education and EdTech*.
44. Islam, Wang, and Hassan, "Delivering Remote Learning Using a Low-Tech Solution".

the effects of different technology alternatives to learning outcomes.[45] Furthermore, an analysis of the effect of technology in Muslim youth in India found that women perceived greater empowerment from learning ICT than men.[46] In the study, women were more likely to agree with statements that learning ICT provided opportunities for independence and freedom from daily tasks. It also allowed them to stay up to date with the world and opened up new job opportunities.

Technology in education can also advance education in healthy life choices. An intervention in Colombia found that a six-month online module was an effective approach to improving teenagers' knowledge and attitudes toward reproductive health and the attitudes toward denouncing and seeking help in the event of sexual abuse.[47] The use of devices and connectivity on any programming tackling reproductive health as well as sexual harassment also implies the need to develop a consistent set of safeguarding measures, including an online safeguarding policy.

Emerging evidence from the COVID-19 pandemic education response has shown the value of "low-tech" solutions and of blending high and low tech. This blended approach can help in reaching the most marginalized girls.[48] For example, a network of volunteers in Kenya was mobilized to distribute printed learning materials, using their mobile phones to: monitor learning continuity, inform parents, boys and girls about the scheduling and frequencies of education radio broadcasts, and to monitor girls' well-being and learning.[49] In Ghana, teachers used WhatsApp during the pandemic to provide lessons, check in on students, help guide and motivate them, and share information on classes available through radio and television.[50]

As with all interventions to improve access and learning, the use of different technologies when applied in education and home settings will have a gendered impact. While it may be difficult for all Tech4Ed initiatives to be gender transformative, it is important to integrate program elements or activities that shift initiatives in this direction.[51] This includes (a) considering the gendered context and intersectionality of gender; (b) setting mechanisms that enable the participation of all children regardless of their gender; (c) ensuring inclusive teaching practices; (d) when possible, co-creating with girls and boys as end users and other stakeholders; and (e) embedding the initiative in families and communities, including relevant engagement around gender norms and tackling harmful stereotypes.[52]

1.5. The Relationship between Technology, Skills and Employment

Technology is rapidly reshaping our world, altering available job opportunities and the skills required to perform them. Predictions indicate that by 2030, automation could phase out around 2 billion jobs, equivalent to half of today's labor force.[53] The World Economic Forum projects that 70 percent of new economic value created in the next decade will come from business models empowered by digital technologies.[54] As AI and other technological innovations advance, the World Economic Forum anticipates that 44 percent of workers' competencies are likely to be disrupted in the next five years, highlighting the need for learning to keep up with this changing demand for skills.[55]

45. Adil, Nazir, and Akhtar, "Investigating the Impact on Learning Outcomes through the Use of EdTech during COVID-19".
46. Khan and Ghadially, "Empowerment through ICT Education, Access and Use".
47. Chong et al., "Do Information Technologies Improve Teenagers' Sexual Education?".
48. Nicolai, Jefferies, and Stepanek Lockhart, "EdTech Evidence from COVID-19 Response".
49. Education Development Trust, *Let All Girls Learn*.
50. Hodor et al., *Voices and Evidence from End-Users of the GLTV and GLRRP Remote Learning Programme in Ghana*.
51. Samuels et al., "How to Design EdTech Programmes That Lead to Gender-Transformative Change".
52. Samuels et al., "How to Design EdTech Programmes That Lead to Gender-Transformative Change"; GPE, *Going Further Together*.
53. McKinsey & Company, *The Economic Potential of Generative AI*.
54. WEF, *The Future of Jobs Report 2023*.
55. WEF, *The Future of Jobs Report 2023*.

Amid these transformations, education systems shoulder a significant responsibility: equipping students with the skills they need to navigate their future, find a job and contribute to the prosperity of their economies. Foundational skills are expected to remain paramount for workers in the 21st century,[56] including decision making, collaboration, communication, digital literacy, socio-emotional competencies and life skills, among others.[57] While many of these skills can be acquired through nonformal learning, formal education plays a crucial role in facilitating the acquisition of additional skills later on.[58] For example, in 2018, individuals with tertiary education in Europe were twice as likely (18 percent) as those with upper-secondary education (9 percent) to engage in free online training or self-study to improve their computer knowledge. Solid mastery of literacy and numeracy skills is also positively associated with mastery of at least some digital skills.[59]

Despite this demand for digital competencies, half of countries globally have not yet defined digital skills standards, and students often have limited access to practice with digital technology in schools. Even in the world's richest countries, only about 10 percent of 15-year-olds used digital devices for more than an hour per week in mathematics and science. Moreover, teachers often feel unprepared and lack confidence teaching with technology.[60]

In low- and middle-income countries, embracing new technologies is especially important to address development challenges and stay relevant in evolving economies and societies. By 2030, an estimated 230 million jobs in Africa will demand various levels of digital proficiency.[61] Yet huge disparities exist in computer science education. A 2023 global review estimated that no students in low-income countries, 5 percent in lower-middle-income countries, 62 percent in upper-middle-income countries, and 43 percent of students in high-income countries take this subject as compulsory in primary and/or secondary education.[62] This discrepancy poses risks for future economic dividends, especially considering the increasing demand for digital proficiency in job markets. This also calls for governments to design strategies and establish partnerships that prepare education systems to (a) keep up with the changing demand for skills; (b) focus on human-centered skills that cannot be automated, such as critical and analytical thinking, problem solving, collaborative and adaptability skills, and other socio-emotional skills; and (c) enable learners, teachers and education managers to work with technology to improve equitable access and learning outcomes.

56. WEF, *The Future of Jobs Report 2023*.
57. GPE, *Evidence for System Transformation.*
58. Heckman, "Skill Formation and the Economics of Investing in Disadvantaged Children".
59. Global Education Monitoring Report Team, *Technology in Education*.
60. Global Education Monitoring Report Team, *Technology in Education*.
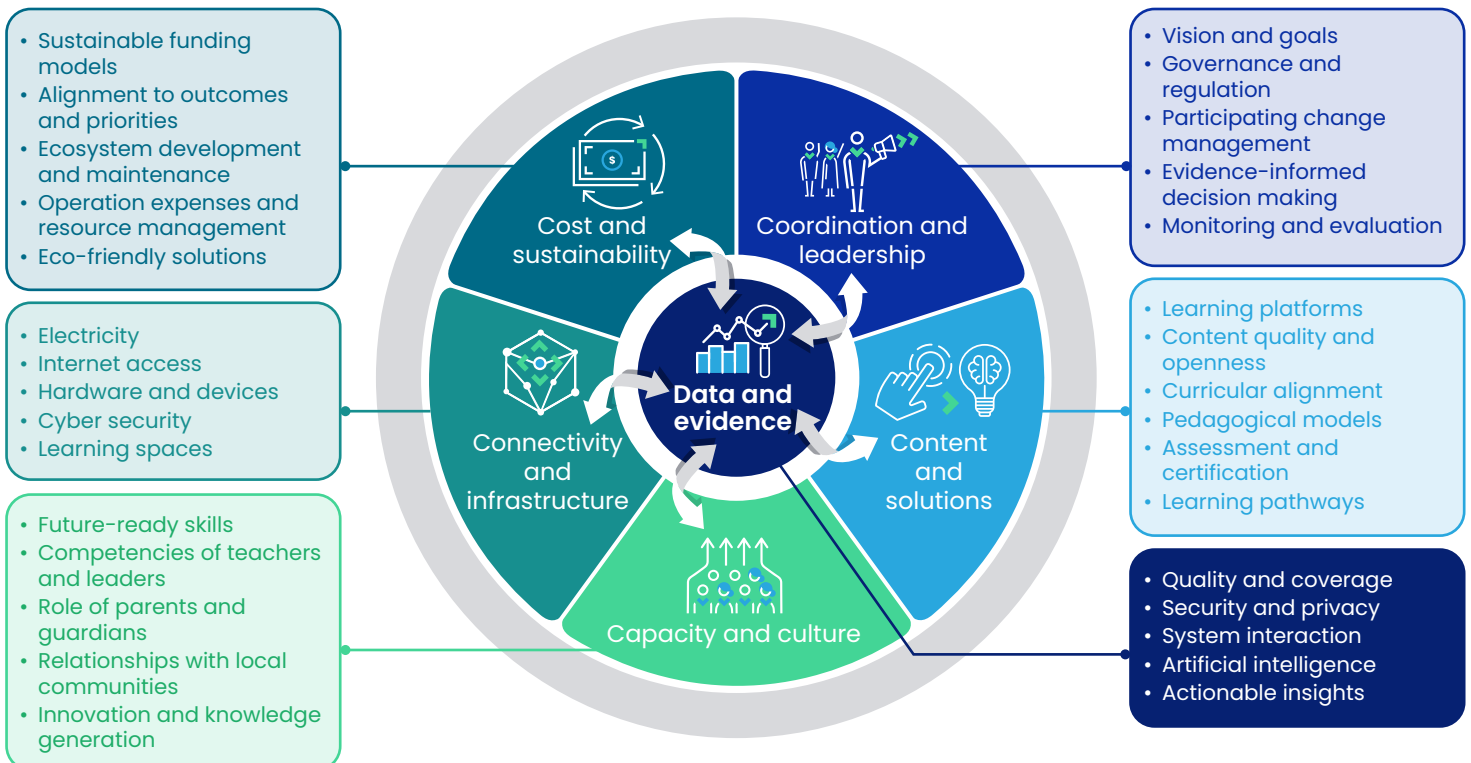61. IFC, *Demand for Digital Skills in Sub-Saharan Africa*.
62. Global Education Monitoring Report Team, *Technology in Education*.

SECTION 2. GPE APPROACH TO TECH4ED

GPE's vision is to support partner countries to transform their education systems through the adoption and use of digital and nondigital technologies wherever these are relevant. This paper outlines GPE's approach to digital transformation of education systems, shares country examples and identifies entry points for GPE and partners. GPE seeks to broker opportunities for partner countries to address priority needs by leveraging the partnership, including research and evidence mobilization, advocacy, fundraising, expertise and in-country capacity support. This long-term vision is guided by countries' potential education goals (see annex 1), the key pillars of the global EdTech framework and the principles of digital transformation in education (sections 2.1, 2.2). The five principles outline the conditions for success and ensure alignment with the GPE 2025 operating model.

Figure 3. Pillars of digital transformation in education

- Sustainable funding models
- Alignment to outcomes and priorities
- Ecosystem development and maintenance
- Operation expenses and resource management
- Eco-friendly solutions

- Electricity
- Internet access
- Hardware and devices
- Cyber security
- Learning spaces

- Future-ready skills
- Competencies of teachers and leaders
- Role of parents and guardians
- Relationships with local communities
- Innovation and knowledge generation

- Vision and goals
- Governance and regulation
- Participating change management
- Evidence-informed decision making
- Monitoring and evaluation

- Learning platforms
- Content quality and openness
- Curricular alignment
- Pedagogical models
- Assessment and certification
- Learning pathways

- Quality and coverage
- Security and privacy
- System interaction
- Artificial intelligence
- Actionable insights

Cost and sustainability · **Coordination and leadership** · **Connectivity and infrastructure** · **Data and evidence** · **Content and solutions** · **Capacity and culture**

Source: Reproduced from UNESCO et al., *Six pillars for the digital transformation of education*, 8.

2.1. Six Pillars of Digital Transformation in Education

To successfully accelerate the digital transformation of education with the purpose to address critical educational challenges, the six pillars—coordination and leadership, connectivity and infrastructure, content and solutions, cost and sustainability, capacity and culture, and data and evidence—need to be prioritized as illustrated in figure 3.

2.1.1. Coordination and Leadership

This pillar suggests a coordinated partnership approach on the basis of a clear vision and evidence-based policies to leverage technology and AI with the aim to achieve education goals. The partnership approach values dialogue and collaboration among stakeholders to develop consensus on strategic priorities, policies, regulations, programs and financing for Tech4Ed. It also promotes cross-sectoral coordination and cooperation to leverage resources, expertise and networks for advancing shared goals in Tech4Ed. This pillar promotes engagement with a diverse range of partners, including the private sector, nongovernmental organizations, foundations, international financial institutions, research institutes and government ministries whose mandates focus on education, ICT, infrastructure and energy.

Country-level coordination mechanisms and gender-responsive education sector plans provide the foundation for better addressing challenges, including system resilience issues,[63] through technology. They also strengthen the role of education in promoting digital skills development for all. GPE therefore supports the mobilization of partners' capabilities, including the private sector and philanthropies, under the leadership of the government, in support of digital transformation planning, implementation, resource mobilization and knowledge sharing. Adopting a consultative approach to plan, monitor, evaluate and learn from the implementation of technology in education is crucial to build

an understanding about how technology and AI can work for education system transformation.

Ensuring strong leadership requires a good understanding of the ecosystem, risks and opportunities to leverage technology and AI for education (see box 1). It is also critical that national education digital transformation roadmaps and regulations are informed by evidence as well as aligned with education sector plans and national digital transformation strategies to ensure that education systems benefit from broader investments and institutional strengthening opportunities. Strong accountability mechanisms enacted in national systems and embedded in implementation approaches are critical to the success of policies and programs in ensuring digital solutions are leveraged in an equitable, inclusive, efficient, sustainable and safe manner.

2.1.2. Connectivity and Infrastructure

Digital infrastructure is an important step in a country's journey toward the digital transformation of education.[64] Connectivity includes various types of technologies and infrastructure, such as 3G, 4G, 5G, fiber optic and satellite connectivity, and other digital infrastructures, such as the Internet of Things, which allows for more advanced connectivity.[65] Connectivity also includes physical devices, protocols and standards to ensure secure data sharing. Other types of required infrastructure include virtual computing environments for the efficient deployment and management of applications and digital services, as well as electricity and adequate facilities for the hosting of computer servers and networking equipment. In the case of education, school construction norms must consider smart learning spaces required to store physical devices and accommodate teachers and students for effective use of digital platforms.

Equal access to electricity, devices and internet connectivity in both rural and urban areas is crucial to ensure equitable access to EdTech and online content. As

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63. See annex 2 for a deep dive on the relationship between technology and system resilience.
64. Vagadia, "Data Connectivity and Digital Infrastructure".
65. SDG Digital, "SDG Digital Acceleration Agenda".

BOX 1. ENSURING A COORDINATED POLICY ENVIRONMENT FOR TECH4ED: VIET NAM, THE PHILIPPINES AND COLOMBIA

As the world embraces digital learning, Viet Nam, the Philippines and Colombia offer great learning opportunities about leadership and collaborative engagement while capitalizing on opportunities in educational technology.

Since 2017, the government of Viet Nam has been taking effective measures to ensure effective integration of technology in education. The purpose of these regulations is to increase access to education, improve its quality and enhance the efficiency of the education system through technology integration.[a] In conformity with various laws regulating use of technology and education in Viet Nam, the prime minister's office, Ministry of Education and Training, and Ministry of Information and Communications have issued various decisions and circulars to strengthen the application of technology in management, teaching and learning. In addition, the national assembly has approved regulations around digital safety, which are currently being rolled out by the education ministry in collaboration with the cybersecurity bureau. The regulatory framework instruments in Viet Nam identify funding sources for ICT infrastructure development in schools, including hardware, software and internet access, and encourage public-private partnerships to invest in EdTech.

To leverage technology for effective education delivery, the Department of Education in the Philippines has developed strategic partnerships with universities, private sector actors and donors like the Asian Development Bank and the Japan Fund.[b] As a result, initiatives like the 'Last Mile Schools' project were launched whereby education stakeholders provide support to ensure availability of infrastructure and devices, build capacities of teachers and school personnel, and raise awareness about the role of technology in education.[c]

In Colombia, the emphasis on public-private partnerships and community-driven projects showcases collaborative efforts shaping EdTech initiatives. These initiatives focus on fostering localized skills development. This was exemplified when the Ministry of Education, together with development partners, communities and schools, implemented the *Aprender en Casa* (Learning from Home) initiative in response to the COVID-19 pandemic and launched other initiatives like *Escuelas Conectadas* (Connected Schools), which ensure students and teachers have access to digital learning materials and promote digital literacy.

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a. Le et al., "Technology in Education."
b. Malipot, "EdTech Company Partners with DepEd, Local Universities to Boost PH Education."
c. Espinosa et al., "Technology in Education."

digital infrastructure requires significant investment, it is important for partners—including private sector partners as well as ministries in charge of education, infrastructure and ICT—to mutualize their resources. This is to ensure teaching and learning institutions' infrastructure benefits from broader digital infrastructure initiatives at the national level. To close the digital divide between urban and rural areas, partner countries should adopt strategies and regulatory frameworks to boost private investments in ICT infrastructure, engage with private sector partners to zero-rate digital platforms and facilitate access to offline teaching and learning content.

When setting up digital infrastructure in schools, eco-friendly solutions and efficient management of devices are sustainable options to minimize electronic waste and contribute to protect the environment. Connectivity should be deployed efficiently, ensuring

BOX 2. CONNECTING SCHOOLS AND INVESTING IN INFRASTRUCTURE: THE GIGA INITIATIVE IN THE KYRGYZ REPUBLIC

The Giga Initiative, launched by UNICEF and the International Telecommunication Union (ITU) in 2019, represents an effort to connect every school in the world to the internet. This ambitious project goes beyond just providing internet access and looks to harnessing connectivity as a force for broader social and economic development.

In the Kyrgyz Republic, the Giga Initiative's impact has been particularly noteworthy. The government's ability to visualize all schools and their connectivity status on a map enabled them to renegotiate existing contracts for internet connectivity. This renegotiation led to a significant increase in internet speed, as well as a cost reduction that resulted in a 40 percent savings in the education connectivity budget, amounting to US$200,000 per year. This success exemplifies how a strategic use of data can lead to substantial improvements in internet connectivity for educational purposes while also ensuring fiscal responsibility and sustainability. It also highlights the importance of government involvement, strategic partnerships and the use of data to drive decision making in EdTech initiatives.

Other countries are also making concerted efforts to address connectivity and infrastructure in education. In Rwanda, the government has invested in solar-powered schools to ensure reliable electricity for internet connectivity, particularly in rural areas. This partnership between the ministries of education and infrastructure has been instrumental in providing consistent power supply, enabling digital learning. Ghana has invested in building smart classrooms equipped with digital learning tools and internet connectivity, transforming the traditional learning environment and enhancing student engagement and learning outcomes. In Viet Nam, the government has implemented centralized procurement systems for EdTech, ensuring cost-effectiveness and standardization across schools. This approach has streamlined the process and reduced costs, allowing more schools to access digital tools.

resources are not underutilized (see box 2). Therefore, management strategies of device distribution, use and maintenance must be defined and applied across the education system, including teaching and learning institutions.

Partner countries are encouraged to adopt regulations, standards and protocols that guarantee the safety, security, data protection and privacy of users when designing digital systems. Private sector partners supporting the rollout of digital transformation should ensure transparency about the data they collect to improve digital solutions. In parallel, raising awareness

about the online risks and offering support on how to ensure safe digital experiences and be an informed digital citizen is an important pillar in ensuring safe and equitable access to digital infrastructure.[66]

2.1.3. Content and Solutions

GPE prioritizes pedagogical approaches that enhance early learning, foundational literacy and numeracy, socio-emotional learning as well as the wider range of skills that equip students for the 21st century.[67] Approaches such as structured pedagogy, teaching at the right level, ensuring adequate access to books and other

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66. UNICEF South Asia, "5 Ways to Protect Your Young Child Online".
67. GPE, *GPE 2025 Strategic Plan*.

learning materials, and attention to language of instruction issues in the early grades are proving to make a difference in various contexts around the world. But without a strong focus on equity and inclusion, as well as conducive enabling factors (for example, data and evidence on learning, gender-sensitive policy, planning and monitoring, sector coordination and financing), it is challenging to make and sustain such advances at scale.[68]

A technology-facilitated educational environment can also serve as a platform for fostering analytical and creative thinking, empathy, as well as collaboration, communication, leadership and other social skills. Technology can contribute to equipping students with the necessary 21st century skills required for the future of jobs in a world where technological advancements are increasingly frequent.[69]

Alignment between content, pedagogy and digital learning platforms is pivotal for the success of educational initiatives (see box 3). Curriculum for formal and nonformal education should include innovative and inclusive pedagogies as well as relevant and unbiased

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BOX 3. ALIGNING DIGITAL LEARNING PLATFORMS WITH RELEVANT CONTENT AND SOUND PEDAGOGICAL APPROACHES: SOUTH KOREA AND INDONESIA

South Korea and Indonesia recognize the transformative potential of educational technology and have implemented initiatives to modernize their education systems to prepare students for a digitally driven future.

South Korea's 'Smart Learning Program,' launched in 2011, develops digital textbooks and interactive multimedia content on the basis of the curriculum and the comprehensive assessment framework while training teachers to seamlessly align these resources with pedagogical goals.[a] A study found that the investments made by South Korea into the program before the COVID-19 pandemic helped Korean students maintain their average performance during the pandemic.[b] In 2023, the Ministry of Education launched an innovation plan to transform education digitally, introducing a phased approach focusing first on the math and English curricula, and also redefining the role of teachers as facilitators providing individualized support to learners. The plan is supported by "AI digital textbooks development guidelines" and the creation of 300 digital leadership schools.[c]

In Indonesia, the Ministry of Education and Culture launched the _Merdeka Belajar_ (Freedom to Learn) initiative, which promotes progressive teaching practices and personalized learning experiences for students.[d] Building on this approach, the ministry adopted an interactive learning platform aligned with the Indonesian curriculum; it includes teaching and learning resources, digital classrooms, a virtual laboratory and a question bank for formative assessment.[e] The ministry has also partnered with other learning platforms such as Smart Classes, Google Indonesia, Your School, Microsoft, Quipper and Zenius to enhance accessibility.[f]

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a. Ra, Kim, and Rhee, _Developing National Student Assessment Systems for Quality Education_.
b. World Bank Group Korea Office, "EdTech in COVID Korea."
c. Ministry of Education of Korea, _Prepare for an Unprecedented Textbook Experience Ahead!_; Seo, _Digital Transformation of Education_.
d. Santosa, "Freedom to Learn (Merdeka Belajar)."
e. Sihombing et al., " 'Merdeka Belajar' in an Online Learning during the COVID-19 Outbreak."
f. Abidah et al., "The Impact of COVID-19 to Indonesian Education and Its Relation to the Philosophy of 'Merdeka Belajar' "; Sihombing et al., " 'Merdeka Belajar' in an Online Learning during the COVID-19 Outbreak."

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68. GPE, _Evidence for System Transformation_.
69. WEF, _New Vision for Education_; Masterson, "Future of Jobs 2023".

content and assessment strategies to ensure acquisition of 21st century skills.[70] Learning platforms designed in conformity with context-relevant curriculum should provide relevant learning pathways for students to thrive in a digital world. Therefore, as part of the curriculum, digital skills frameworks and benchmarks must be defined for teachers and for students in each grade. The digital platforms designed to support the delivery of the curriculum must be accessible, interactive and multimodal and include features that allow for personalized learning, collaboration and protection of children's safety and privacy. A set of minimum standards should ensure the quality of the content and that digital learning platforms can be easily assessed and adjusted as necessary.

By aligning technology with effective pedagogical principles,[71] it creates a holistic learning experience for students. For example, using digital tools for formative assessments enables teachers to track student progress in real time. Teachers are empowered to concentrate on personalized student support rather than overburdened by extensive manual assessments. Moreover, tailored digital platforms that can automate repetitive tasks, such as lesson planning and resource creation, have the potential to improve teaching and learning because teachers can access predesigned digital modules, freeing up time for innovative pedagogical approaches.

2.1.4. Cost and Sustainability

The cost of digital transformation initiatives is generally underestimated as costing estimates often neglect maintenance costs.[72] An understanding of effective costs and an assessment of the potential financing gap should guide country partners' strategies to mobilize resources for education digital transformation. This can be achieved through the development of a realistic and sustainable business model—namely, one that can be maintained by internal resources over time and does not rely on external support.

The Giga Initiative, under the leadership of UNICEF and ITU, in collaboration with Boston Consulting Group, conducted an assessment of funding models to connect all schools to the internet.[73] This paper suggests an adaptation of the main findings of that assessment to ensure realistic costing and sustainable financing of all the pillars of digital transformation in education. Therefore, a comprehensive and effective Tech4Ed business model should include the following:[74]

›	Technical advisory services to develop strategic instruments, supporting the creation of a cohesive environment for further investments.

›	Choice of technologies that are the most appropriate to achieve education goals.

›	Costing structure, which is composed of:
  •	The initial investment to develop infrastructure such as electricity, connectivity, devices, digital learning and administrative platforms, data storage, and including the cost to acquire technical assistance.
  •	Operational expenses to maintain the overall infrastructure and track progress of the digital transformation processes.
  •	Capacity building and engagement of leaders, teachers, students, parents and communities.

›	Funding models, which consist of sustainable resource mobilization that comes in the long run from one or a combination of the following stakeholders: government, national private sector partners, philanthropies and community-based organizations. In the short term, it is possible for a proportion of the funding to come from multilateral or bilateral donors, international nongovernmental organizations, as well as philanthropic organizations and foundations.

70.	Scott, *The futures of learning 2.*
71.	An overview of pedagogical principles can be found on the Structural Learning website at https://www.structural-learning.com/post/pedagogy-for-teaching-a-classroom-guide.
72.	Global Education Monitoring Report Team, *Technology in Education.*
73.	Giga and Boston Consulting Group, *Meaningful School Connectivity.*
74.	Adapted from the assessment of sustainable business models for school connectivity developed by the Giga Initiative in collaboration with the Boston Consulting Group.

BOX 4. FINANCING LEARNING CONTINUITY USING A HYBRID APPROACH THROUGH A PUBLIC-PRIVATE PARTNERSHIP: UKRAINE

As part of the response to the impact Russia's invasion of Ukraine has had on education, the Ministry of Education, GPE, Microsoft, Google, UNESCO and UNICEF have partnered to mobilize more than $51 million in grants and in-kind donations to support learning continuity using technology. The initiative consists of three components:

> Procurement of devices and connectivity
> Organization of hybrid catch-up classes and teacher capacity building
> Distribution of teaching and learning materials and tools.

These resources were mobilized through the GPE Multiplier, an innovative financing mechanism that provides the incentive needed to catalyze larger and better investments in the education sector aligned to national priorities. The GPE Multiplier complements other sources of external financing. It can be invested in the form of a grant or used to lower interest rates on concessional loans taken out from, for example, multilateral development banks or bilateral donors.

To facilitate obtaining an allocation and to mobilize new and different sources of financing, a lower matching fund requirement is possible for different partners through the Multiplier. Private sector partners and foundations can help unlock funding from the Multiplier at a 1:1 ratio, meaning one additional dollar contributed for every dollar obtained from GPE. Other donors—including bilateral and multilateral donors— must still meet the Multiplier's funding ratio of $3 in additional resources to $1.

GPE has matched a total of over $25 million in cash and in-kind support from Microsoft, Google and UNESCO for Ukraine, totaling more than $51 million in education assistance for the country. The support includes cash donations from both private sector partners and UNESCO. Microsoft's support includes no-cost access to its software for students and teachers and teacher training on software programs, while Google's contribution includes a donation of 50,000 Chromebooks. This is the first time that private sector partners have provided the necessary cofinancing for a country to unlock funding from the GPE Multiplier through a combination of cash and in-kind donations.

These contributions are helping advance Ukraine's efforts to ensure the continuity of teaching and learning and to digitalize its education system, bridging emergency response and longer-term assistance to help the sector better withstand the impact of the conflict.

Studies have found that a combination of funding modalities and rigorous management is needed to fill the resources gaps for educational digital transformation in low- and lower-middle-income countries.[75] These funding modalities may include both traditional and innovative financing instruments. GPE has been trialing some of these financing tools in more than 44 partner countries (see box 4 for an example) as well as provid-

75. Giga and Boston Consulting Group, *Meaningful School Connectivity*; Roddis et al., "Financing for the EdTech Ecosystem".

ing incentives to increase domestic and external financing.[76] These financing tools are used either as a grant or to lower the interest rate on concessional lending. The current GPE funding modalities include system capacity grants,[77] system transformation grants,[78] the GPE Multiplier,[79] Debt2Ed,[80] GPE match[81] and the Arab Coordination Group Smart Education Financing Initiative (ACG SmartEd).[82] The processes to access these resources are country-led as they identify their priority reforms and areas where technology can play a role in transforming education systems.

2.1.5. Capacity and Culture

The development and rollout of digital transformation processes require education institutions with efficient organizational structures whereby leaders, teachers and students are equipped with relevant and adequate digital skills. This offers an opportunity to assess institutional capacity and individual skills gaps within the education sector and to work closely with the private sector to upskill or reskill education officials to create a culture of innovation (see box 5).

Education ministries could consider developing long-term strategic plans to build the capacity of relevant stakeholders based on their roles and responsibilities to promote digital literacy at all levels of the education system. Leaders should be equipped with the relevant level of information on benefits and challenges of technology, including AI, to set the right vision and regulations; adopt appropriate principles and manage risks; strengthen evidence-based cross-sectoral planning and intersectoral coordination; and guide the implementation and course correction of Tech4Ed initiatives.[83]

As emerging technologies redefine teaching and learning processes, teacher professional development should adapt and respond to the new educational needs and ensure effective learning continuity in case of emergency. This includes engaging and empowering teachers, and building their confidence to effectively utilize digital tools, including AI, with the aim to ensure personalized learning experiences that cater to the diverse profiles and needs of students.

Managing change[84] and engaging stakeholders as early as possible throughout the digital transformation process improve the effectiveness of technology integration in education. Both require a priori analysis and understanding of the organizational culture and structures, leadership and management style, and the culture of educational institutions in terms of processes, practices and the perceptions of change agents.[85]

During the change process, it is crucial to sensitize stakeholders about digital transformation goals, to collect feedback from users for the design of digital transformation strategies and learning solutions, and to ensure trainings and technical support to facilitate interactions between users and the technologies (see box 5). In other words, sustainable digital transformation requires ownership of educational change. Kim, Yang and Lim argue that systemic change comes from (a) developing and consistently disseminating messages about policy change from the national to local level; (b) opening up space for all stakeholders to reflect, understand the purpose of the proposed change and generate new ideas in order to become "active agents of change"; and (c) creating a culture of organizational creativity that ensures flexibility for policy implemen-

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76. Tammi, Atis, and Vivekanandan, "Adapt and Learn".
77. The system capacity grant builds national capabilities to develop, implement and monitor education sector plans and policies.
78. Using the system transformation grant, partner countries make focused, evidence-based investments in programs that address barriers within systems to drive change.
79. The GPE Multiplier pools investments for education by securing new and additional funding at a ratio of $1 from the Multiplier for every $3 from development partners and dollar-for-dollar matching from businesses and foundations.
80. Debt2Ed is a financing mechanism integrated within the Multiplier that transforms a partner country's sovereign debt (through a debt swap or a loan buy-down) into new investments for education, pooling funds from diverse cofinancing partners.
81. GPE Match is a dollar-for-dollar matching mechanism that incentivizes investments in education from the business community.
82. Developed by ACG and GPE, ACG SmartEd leverages the Multiplier at a 1:4 funding ratio for holistic education investments. It combines grant capital with concessional lending to lower the cost of education investment for countries.
83. UNESCO, *AI and Education*.
84. *Change management* is "the process of continually renewing an organization's direction, structure, and capabilities to serve the ever-changing needs of external and internal stakeholders" (Moran and Brightman, "Leading Organizational Change").
85. Saghafian, Laumann, and Skogstad, "Stagewise Overview of Issues Influencing Organizational Technology Adoption and Use".

tation, access to needs-based resources, and efficient communication channels to share relevant knowledge and information.[86]

2.1.6. Data and Evidence

This pillar focuses on the optimization of education management standards and processes for more efficient education service delivery in terms of the availability of quality data for better allocation of human, material and financial resources. It also highlights the importance of data to build effective AI models for teaching and learning and to generate evidence about the effectiveness of education systems.

BOX 5. BUILDING TEACHERS' CAPACITY AND ENGAGING STAKEHOLDERS FOR TECHNOLOGY ADOPTION AND USE: INDIA AND KENYA

Comprehensive Teacher Training Programs

India's approach to scaling up institutional capacity involves a focus on teacher training programs. The National Program on ICT in Schools has been instrumental in enhancing digital literacy and pedagogical skills among educators. The initiative trained over 1 million teachers across the country based on a thorough needs assessment to identify specific gaps in digital literacy and pedagogical skills among educators. The customized curriculum for teacher training is meticulously designed to address these gaps, ensuring relevance and practicality in classroom settings. The training employs diverse methods, including workshops, online courses and mentoring sessions, catering to varied learning preferences among teachers. Continuous evaluation mechanisms are integrated to assess the effectiveness of the training, allowing for real-time adjustments and improvements.

In Kenya, the Kenya Institute of Curriculum Development, in collaboration with various partners, launched 'Digischool'—an initiative that focuses on training teachers to use digital tools and resources in the classroom for more engaging and effective teaching. Through a series of workshops, webinars and hands-on training sessions, Digischool has successfully reached thousands of teachers across the country. A key aspect of this teacher training is the customization of training content to align with the specific needs and challenges faced by Kenyan educators. The approach has garnered positive feedback from teachers who appreciate the relevance and applicability of the training content to their specific contexts.

Managing Change at Institutional and Individual Levels

India's success in scaling up capacity for Tech4Ed is closely tied to government-led initiatives. The 'Digital India' campaign, a flagship program of the government, played a pivotal role in creating an environment conducive to Tech4Ed adoption. The campaign also facilitated collaborations with leading technology companies, resulting in the establishment and use of digital classrooms in over 100,000 schools.

In Kenya, the 'Digital Literacy Program' was led by the government with the goal of sensitizing and equipping primary school teachers with the necessary skills to integrate technology into their teaching practices. Launched in 2016, the program raises awareness and offers training for teachers on how to use digital devices for interactive and engaging lessons. Research by the Kenya Institute of Curriculum Development shows a positive correlation between program implementation and improved student engagement and learning outcomes. Teachers enrolled in the program report increased confidence in using digital resources, leading to more innovative and student-centered approaches to teaching.

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86. Kim, Yang, and Lim, "Owning Educational Change in Korean Schools".

Education systems often lack mechanisms to manage and apply data when making decisions about how to allocate human, financial and material resources.[87] This gap contributes to inefficiencies which in turn affect education access and learning for students in general and the most vulnerable ones in particular.

Technology is being used in various GPE partner countries to enhance the production, accessibility and use of reliable and timely data across all levels of the education system to improve effectiveness. However, to leverage the power of technology for the improvement of system efficiency, data policy and education standards and processes must be optimal and clearly defined

to ensure system readiness for automation. Therefore, clear strategies and protocols to manage students, teachers, teaching and learning materials, and schools' assets must be well established.

The definition and optimization of standards and processes create preconditions for technology to accelerate the efficiency of education services delivery through integrated, interoperable and coherent systems as it becomes easier for policy makers to access data and make data-driven decisions (see box 6). Leading practices in efficient education management involve the integration of digital tools and platforms, based on streamlined and context-specific processes and stan-

BOX 6. STREAMLINING PROCESSES AND STANDARDS FOR SYSTEM EFFICIENCY: MALAYSIA, RWANDA AND VIET NAM

Malaysia and Rwanda are on a journey to achieve remarkable levels of efficiency in teacher management through streamlined processes and technology integration, while Viet Nam has adopted standards to guide the development of digital platforms for efficient education management. By optimizing and automating the processes for teacher management, Malaysia, Rwanda and Viet Nam are promoting data-driven decision making and ensuring greater transparency.

A key feature of Malaysia's approach focuses on setting a clear strategy to promote teaching as a prestigious profession through the Malaysia Education Blueprint (2013–2025). This includes the development of a TMIS—an integrated platform that manages teacher data and facilitates equitable teacher allocation, including addressing regional disparities in teacher distribution.

In Rwanda, the rapid expansion of the education system has generated pressing needs for more efficient teacher management to recruit and retain qualified teachers. Consequently, for the past five years, the country has embarked on a journey to improve efficiencies in teacher management. In 2020, the country issued a presidential order establishing special statutes governing teachers which informed the requirements to develop a TMIS. As well as addressing regional disparities in teacher distribution, this system has been used to generate data and evidence on teacher needs, recruitment and capacity development gaps, and to coordinate teacher training.

The Ministry of Education and Training in Viet Nam adopts standards and technical requirements to support education management. The regulations also outline the responsibilities of educational institutions, relevant government agencies and individuals in ensuring the accuracy, completeness and reliability of data. These processes and standards lay the appropriate foundation on which to optimally develop digital platforms for teaching and learning management.

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87. EdTech Hub, "What We Are Learning/What We Are Reading".

dards, to manage resources effectively and enhance the learning experience.[88] The key is to adapt education management processes to ensure they meet the specific needs of local contexts and the education system they are serving. Optimal design of processes relies heavily on national and subnational education managers, school administrators and teachers to shape and guide technology use for improved system effectiveness and learning outcomes.

Subnational and national leaders are crucial in setting standards and defining processes. For example, they play an important role in designing teacher management policies and procedures where standards and processes are defined for teacher recruitment, teacher licensing/certification, efficient and equitable teacher allocation to schools, teacher performance evaluation and conditions for promotion, and teacher professional development. Education authorities play a similar role in the definition of processes around resource allocation at the decentralized level, the management of student

participation, comprehensive learning assessment as well as schools' assets.

2.2. Five Principles Guiding the GPE Approach to Tech4Ed

Five key principles (see figure 4) have been identified to mitigate the risks posed by the integration of technology in education, in terms of inequity, social, psychological, privacy and security risks. As part of the process to transform education systems, partner countries are encouraged to adopt digital transformation approaches that are:

1. Purpose-driven in line with relevant education priorities
2. Led by the needs of country context
3. Sustainable and scalable
4. Designed for all
5. Safe and secure.

Figure 4. Principles of digital transformation in education

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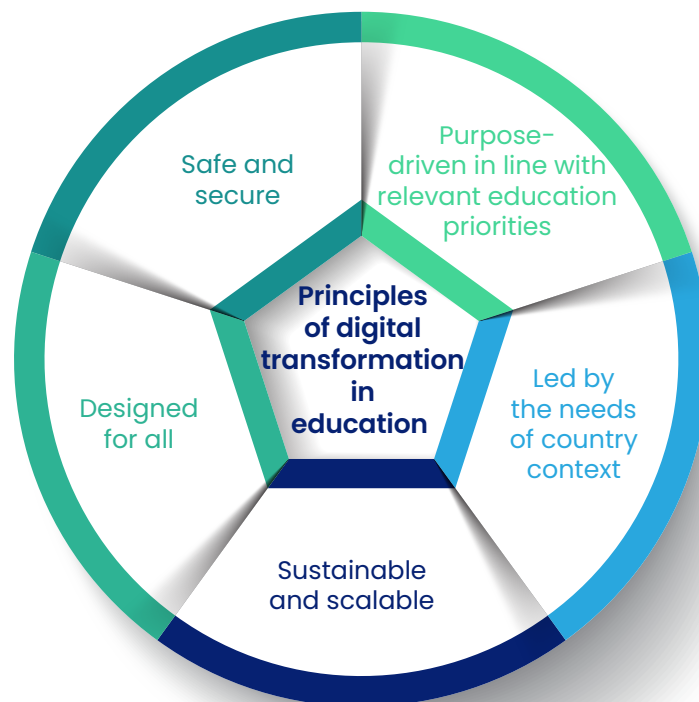
88. Wyk and Crouch, *Efficiency and Effectiveness in Choosing and Using an EMIS.*

2.2.1. Purpose-Driven in Line with Relevant Education Priorities

Digital transformation of education is not an end but a means to address major education system challenges around access to education, teaching and learning, education and employability, and education management. Furthermore, as evidence on effective digital solutions is scarce, it becomes even more crucial to build a knowledge base and for governments to adopt equitable, efficient and sustainable digital solutions for education that are driven by evidence. Consequently, partner countries must invest in assessing and diagnosing their level of Tech4Ed readiness, identify barriers to education system transformation and determine if any existing or emerging technologies are best placed to sustainably address the identified challenges. Once an evidence-based solution is selected, partner countries should invest in mobilizing evidence on best practices for scaling up in their respective context to create conditions for success, avoid unintended negative consequences and adopt more agile governance and planning frameworks.

2.2.2. Led by the Needs of Country Context

Successful digital transformation processes consider the specificities of the context in which they are being rolled out and ensure that solutions are codesigned with national stakeholders. Contextualization and local ownership reinforce the user-centered approach as well as relevance, adoption and use of the proposed solutions. This principle sets the foundation for effective change management. It creates the conditions to incentivize political will, build on local ecosystems, ensure alignment of resources and capabilities among partners, and promote mutual accountability.

2.2.3. Sustainable and Scalable

Sustainability and scalability of digital transformation solutions are closely linked as the former leads to the

latter. Therefore, designing for scale requires a well-thought-out sustainability framework that factors in the rapid evolution of technologies. However, investments to improve accessibility to technology often neglect sustainability.[89] Sustainable digital transformation of the education system requires an effective multistakeholder approach and a strong collaboration framework between the public and private sector because one sector alone cannot ensure sustainability and scalability. Sustainable digital transformation seeks to encourage minimum wastage and efficient use of resources as well as the provision of better coverage of education services at the national level. It also considers the environmental impact of integrating technology in education at scale and the well-being of users.

2.2.4. Designed for All

With a third of the world's population unable to access the internet,[90] governments should adopt approaches and the right combination of education technologies that allow for equitable and inclusive access to education. Dimensions related to equity and inclusion must be integrated within each stage of the digital transformation process, from the country readiness assessment to the monitoring of outcomes generated using digital solutions. This principle also calls for gender equality to be taken as a key consideration in the efforts to ensure greater accessibility to devices and AI tools as well as the opportunities to contribute, regardless of gender, in the digital economy. Equitable access to Tech4Ed for boys, girls and the most marginalized children requires a major change of mindsets and behaviors across all education stakeholders and households. If gender dynamics are not taken into consideration, the use of Tech4Ed risks further deepening existing gender disparities in education.

2.2.5. Safe and Secure

While technological innovation offers excellent opportunities to improve education, it includes risks related

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89. Global Education Monitoring Report Team, *Technology in Education.*
90. ITU, *Measuring Digital Development.*

to privacy, security and well-being.[91] The successful deployment of existing and emerging technologies to address critical education challenges requires a good understanding of the associated risks, close collaboration across the Tech4Ed ecosystem and mechanisms to boost public trust. Through legislation, country partners must proactively prevent harmful behaviors online, protect users by enabling them to report harmful content, and promote safety principles in the design of digital solutions for education while ensuring that government and Tech4Ed industry goals are aligned.

Regulatory and ethical frameworks as well as agile data governance policies and protocols must be in place to inform the design of secure, responsible, trusted and culturally relevant digital technology solutions and AI tools. In addition to national regulations, teachers must have autonomy to manage their classrooms in a way that reduces the excessive use of technology, given the potential effect on mental and physical well-being of students, and promotes the reasonable and fair use of technology for learning instead.

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91. Global Education Monitoring Report Team, *Technology in Education*; WEF, *Shaping the Future of Learning*.
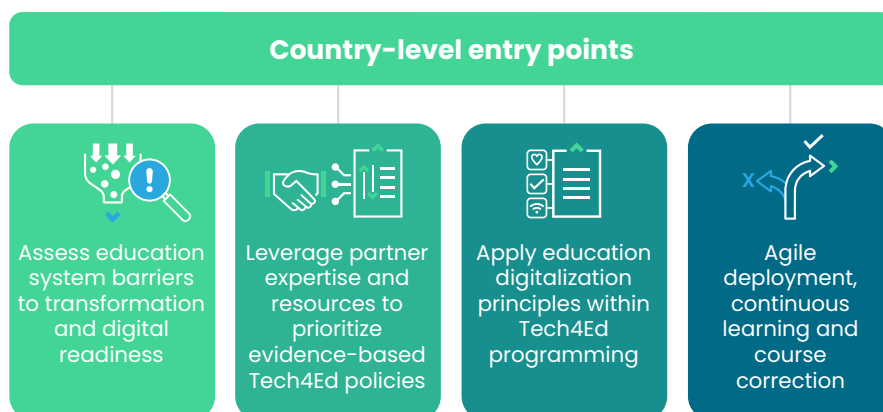
SECTION 3. OPERATIONALIZATION OF THE GPE APPROACH ON TECH4ED FOR SYSTEM TRANSFORMATION

GPE is committed to supporting partner countries to build system resilience and transform education systems by mobilizing partnerships and investments, leaving no one behind. GPE's approach consists of engaging and working with all relevant partners within and outside the education sector under the leadership of governments in support of priority reforms. Through this approach, GPE leverages global and national expertise and resources to enable policy change and build national capacity in areas critical

to efficient, effective and resilient education systems. GPE also relies on its partnership approach to embrace innovations that have the potential to accelerate the implementation of priority reforms and achieve countries' education goals. Figures 5 and 6 illustrate areas in which GPE has found tangible opportunities in operational processes to harness technology and AI to contribute to system transformation.

3.1. Country-Level Entry Points

Figure 5. Entry points for digital transformation in education at the country level

Country-level entry points

| Assess education system barriers to transformation and digital readiness | Leverage partner expertise and resources to prioritize evidence-based Tech4Ed policies | Apply education digitalization principles within Tech4Ed programming | Agile deployment, continuous learning and course correction |

3.1.1. Assessing Education System Digital Readiness and Barriers to Transformation

In the early assessment and diagnosis phases of GPE's processes, members of the local education group support government-led analysis of the policy environment and education system. This phase includes collecting evidence on and analysis of the education challenges and determining the role digital innovation could play to address them. At this stage, partner countries also have an opportunity to assess their digital readiness while looking at the digital ecosystem in general and the Tech4Ed ecosystem in particular. The digital readiness analysis includes several key questions:

➤ Does the country have regulatory frameworks and policies, an adequate organizational structure and collaboration mechanisms in place to guide the digital transformation processes in education?

➤ Are there streamlined processes, protocols and technical standards to manage the education system based on efficient production of data and evidence?

➤ What characterizes the funding landscape for supporting digital transformation initiatives that are in line with broader education goals?

➤ What is the institutional and individual capacity and appetite to adopt and use technology for system resilience and transformation, from the national to the school level?

➤ Are there context-relevant, future-ready, competency-based, inclusive and accessible teaching and learning content and sound pedagogical approaches?

➤ How available, reliable and accessible are the technical and digital infrastructures to enable the deployment of digital solutions in education in both urban and rural areas?

To conduct the analysis on education challenges, coun-

tries will continue to rely on the education sector analysis methodology and the screening tool of the enabling factors for system transformation.[92]

3.1.2. Leveraging Partner Expertise and Resources to Prioritize Evidence-Based Tech4Ed Policies

Ministries of education in partner countries use a broad range of evidence of what works and how they work to host an inclusive policy dialogue. This phase culminates in partners aligning behind a prioritized reform area captured in the partnership compact. Country-level education and technology experts must work together to contribute to the process of designing solutions to implement the priority reform while keeping an eye on evidence gaps in terms of how technology can work for education. This is also an opportunity to leverage partners' capabilities and resources and strengthen the collaboration with ministries, departments or agencies in charge of national digital transformation and public infrastructure, as well with private sector partners.

In contexts where the partnership compacts are already completed, partners should seek other opportunities to establish alignment with education digital transformation goals. These opportunities may include the midterm review of the partnership compact or the development of a new education sector plan and/or digital transformation roadmap.

Furthermore, the design process must be informed by evidence, which can be curated or generated as necessary. The monitoring, evaluation and learning plan of the partnership compact (and/or the digital roadmap) should include relevant learning questions to fill evidence gaps on implementation approaches and effectiveness.

3.1.3. Applying Education Digitalization Principles within Tech4Ed Programming

As part of strengthening mutual accountability among partners, the local education group must ensure the

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92. The digital readiness assessment can be guided by the forthcoming Digital Transformation Collaboration maturity assessment tool. For an in-depth analysis of education data systems, countries may refer to the forthcoming UNESCO EMIS maturity tool.

adaptation and integration of the digital transformation principles within the partnership compact, digital roadmap and grants development processes.[93] Partners should commit and agree on strategies to adapt as well as communicate and demonstrate how these principles will be applied by all, including by private sector partners and other stakeholders outside of the education sector who have a role in the Tech4Ed ecosystem.

The principles must be considered during all phases of the education digital transformation stages, which consist of assessment, design, deployment of digital solutions, progress tracking and learning.

3.1.4. Deployment, Learning and Course Correction

Building on the partnership compact and digital transformation roadmap, GPE supports countries in implementing their priority reforms through various funding mechanisms,[94] such as the system capacity grant, the system transformation grant, the GPE Multiplier and technical assistance initiatives grants.

One of GPE's technical assistance initiatives is Tech4Ed. It aims to offer targeted on-demand support to countries with intent to scale up Tech4Ed, and a more thorough assessment and integration of technology in education strategic and operational plans. Opportunities for evidence-based learning and peer exchange will be prioritized. Cross-sectoral coordination on ICT, including with ministries of ICT or the country equivalent, private sector and nonprofit EdTech actors as well as development partners engaging on EdTech, will be strengthened to avoid duplications of efforts. More specifically, the technical assistance initiative aims to ensure that ministries of education benefit from the following:

➤ Strengthened capacity to effectively identify and leverage adequate tools and resources to integrate technology across their education system.

➤ Strengthened ability to leverage technology to facilitate the provision of timely and relevant data for education planning and management.

➤ Better positioning to lead and coordinate cross-sectoral strategies (including with ministries of ICT), policies, programs and financing on Tech4Ed.

➤ Continued evidence mobilization of what, how and why tech works for education, equipping ministries of education to generate and use evidence on how to effectively leverage tech to strengthen education systems.

The technical assistance initiative works alongside the other funding modalities mentioned above. Therefore, countries are able to prioritize Tech4Ed interventions to support the achievement of results under their respective priority reforms. The midterm review of the latter is an opportunity for countries to document the lessons learned and adapt their strategies as necessary. In countries where the technical assistance initiative on Tech4Ed is implemented, monitoring and evaluation activities will focus on learning and adaptation objectives. The monitoring, evaluation and learning (MEL) process will track progress; capture lessons; support adaptation of program tools, parameters and approaches (as necessary); and disseminate learnings to interested stakeholders at the country, regional and global levels. It will help address learning questions on, among others, the following:

➤ Alignment and capacity – has the Tech4Ed model provided ministries of education with an efficient, agile model to provide technical assistance to plan, design, implement and evaluate technology in education policies and programs?

➤ Equity – are the ministries of education better equipped to meaningfully address gender and disability disparities in education and tech-enabled

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93. The principles are outlined in the previous section and advocate for digital transformation processes to be (1) purpose-driven in line with education outcomes, (2) led by the needs of country context(s), (3) sustainable and scalable, (4) designed for all and (5) safe and secure.
94. As of 2023, GPE has invested over $100 million dollars to support countries to leverage technology for learning and education management.

education? How can ministries of education meaningfully address gender and disability disparities in education and tech-enabled education through policy and planning, and how can this translate to improved gender equity?

❯ Cross-sectoral coordination – how effective are the cross-sectoral mechanisms and how can ministries of education effectively lead cross-sectoral Tech4Ed initiatives?

❯ Leveraging resources – has the Tech4Ed model attracted additional development partner support for sustainability?

❯ Private sector engagement – what lessons can be learned from engagement with the private sector? At

what point is private sector involvement most effective for success of Tech4Ed implementation? What is the appropriate measure for success of private sector engagement and what could a blueprint for private sector engagement look like?

❯ Peer learning – has the Tech4Ed model been effective at sharing knowledge with partner countries and development partners at the global level?

❯ Fit for purpose – is the digital transformation framework proposed by the global community fit for country adaptation and guidance? Is it a benchmark for guiding policy dialogue?

3.2. Regional- and Global-Level Entry Points

Figure 6. Entry points for digital transformation in education at the regional and global levels

Global- and regional-level entry points

Evidence mobilization, learning exchange and advocacy

Leveraging global and regional expertise and financing for countries

3.2.1. Evidence Mobilization, Learning Exchange and Advocacy

GPE mobilizes evidence and documents countries' practices to support policy dialogue and peer learning at the regional and global levels. GPE engages with global and regional partners through various networks and hubs to advance the evidence uptake agenda in policy design

and implementation, and the partnership convenes global and regional learning events and workshops intended to contribute to informing partner country policy design and implementation on the integration of technology in education. These events are also opportunities for GPE to advocate for evidence-based approaches to integrate technology in education with the purpose to improve education outcomes. Education

Out Loud, GPE's fund for advocacy and social accountability, also works with civil society organizations to amplify evidence and learning on Tech4Ed and advocate for the application of education digital transformation principles.

GPE advocacy work centers on the following:

› Positioning evidence-based and sustainable Tech4Ed approaches as a key element to transforming education

› Amplifying GPE partner voices with successful Tech4Ed results

› Growing GPE's thought leadership in Tech4Ed to support the growing needs of our partner countries.

In addition, the GPE Knowledge and Innovation Exchange (KIX) generates applied research on scaling innovation and on data systems and data use. The initiative also connects expertise through regional hubs to strengthen capacity at the country, regional and global levels for evidence uptake.

Furthermore, the GPE technical assistance initiative plans to engage a broad array of global and regional stakeholders, focusing on adaptation and learning during its pilot phase while sharing insights broadly. Key areas of inquiry include the effectiveness of the Tech4Ed model in aiding ministries of education, its impact on gender and disability disparities, cross-sectoral coordination, resource leveraging, private sector engagement, peer learning and the applicability of the key pillars of GPE's approach to Tech4Ed (see section 2.1).

The combination of actionable research, practices documentation and sharing across countries will strengthen the knowledge base of how Tech4Ed can improve education system resilience, teaching, learning, data systems and education management.

3.2.2. Leveraging Regional and Global Expertise and Financing for Countries

As a partnership, GPE has a vast global and regional network of technical and financial partners, including multilateral and bilateral partners, private sector stakeholders, foundations, collaboratives, coalitions and hubs that can be mobilized to provide technical assistance to countries and be convened to secure financial and political support to advance the education digital transformation agenda with the purpose of improving education outcomes.

Engaging these partners and networks also enables country-level resource mobilization. Partner countries are then able to use GPE grants and programs to catalyze additional country-level cofinancing through the GPE Multiplier and matching funds. This was evident in the support provided to Ukraine (see box 4) to ensure learning continuity by leveraging technology. These networks also avail technical assistance to strengthen countries' capacity to integrate technology in education systems. This is being piloted as part of the Tech4Ed initiative in Ghana and Tajikistan where GPE is leveraging partners' expertise and tools from the Digital Transformation Collaborative.

CONCLUSION

GPE's approach consists of engaging and working with all relevant partners within and outside the education sector under the leadership of government in support of priority reforms. This paper articulates GPE's approach to education digital transformation and how it is being operationalized through a partnership approach.

Technology is a key accelerator to help achieve education goals related to equity and inclusion, effective teaching and learning, digital skills development and efficient education system management. While research on the impact of technology on learning outcomes is slowly growing, significant evidence gaps remain. For Tech4Ed to be effective, it is important that investments in Tech4Ed are informed by evidence and that barriers to successful implementation are properly understood and addressed. Accelerating the digital transformation of education requires a clear purpose as well as commitment and collaboration among all education stakeholders.

The target audience of this paper includes GPE global, regional and country partners. This paper proposes key principles and approaches on how the Tech4Ed ecosystem can work together to leverage existing and emerging technologies to address major educational challenges.

The paper suggests a holistic approach to use technology to support education system resilience. It touches upon the interrelationship between EdTech and system resilience, gender, skills and employment. It also discusses the strategic vision and required capacity for the adoption of digital learning solutions that are proven to be equitable, efficient, effective and sustainable.

The paper identifies entry points and opportunities within the GPE 2025 operating model to provide in-country support and work with partners at the regional and global levels. It provides a starting point for partner countries to plan and roll out more strategically their investments in the digital transformation of their education system. It also outlines opportunities to engage with regional and global partners to foster learning exchange and leverage expertise and resources.

By implementing the approach proposed in this paper and learning from the operationalization, there is the potential to make significant gains toward the transformation of education systems that equip children and young people with the skills they need to thrive in a world dominated by technology and AI.

ANNEX 1: PURPOSE OF DIGITAL TRANSFORMATION IN EDUCATION

Figure 7. Purpose of digital transformation in education
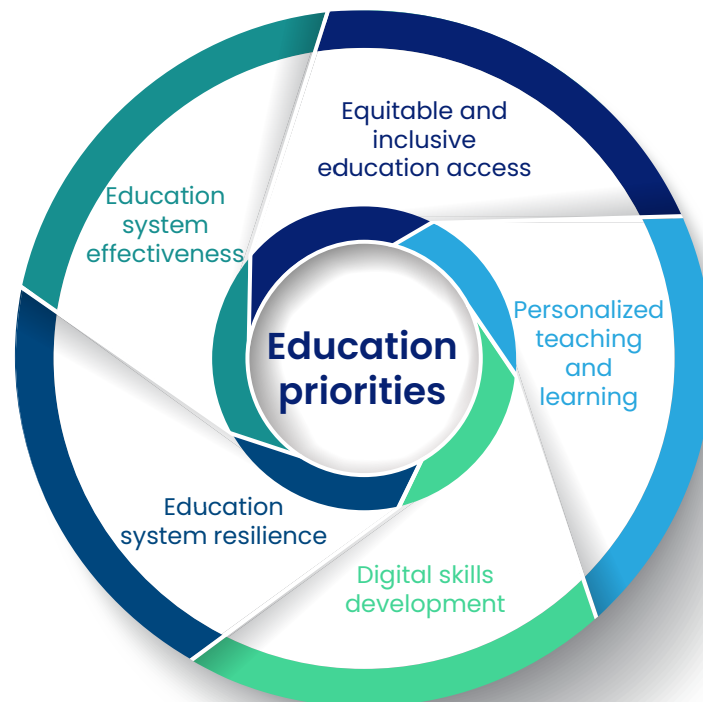
As put forward by GPE, the purpose of digital transformation in education (see figure 7) is understood through the following five goals:

Goal 1: Equitable and inclusive education access
The objective is to ensure equitable access to education and educational content, especially for marginalized groups. Technology can play a crucial role in overcoming barriers such as geographic isolation, lack of resources and specific needs of diverse learners. By employing a range of technological solutions tailored to different contexts, the aim is to make formal and non-formal education accessible to everyone, including children with disabilities, girls, refugees, internally displaced children and other marginalized groups.

Goal 2: Personalized teaching and learning
This goal centers on enhancing the quality of teaching and learning through the strategic integration of technology. The implementation of digital learning solutions should be thoughtfully aligned with pedagogical

practices and assessment frameworks. Establishing standards and benchmarks for digital learning platforms is essential to ensure their appropriate use and effectiveness while maintaining an appropriate balance between screen time and traditional learning methods.

Goal 3: Digital skills development
Education equips children and young people with the skills they need to build their future, find a job and contribute to the prosperity of their economies. Ongoing technological developments continuously reshape the competencies required in the labor market. Digital and AI skills are expected to remain of great importance for workers in the 21st century. Education systems must adapt to remain relevant, meet these changing demands and facilitate smooth school-to-work transition. Governments should therefore strive to keep pace and provide these skills through formal and nonformal education and develop measurement frameworks to assess progress.

Goal 4: Education system resilience

In a time when education systems are affected by multiple crises, building system resilience is as important as ever to ensure learning continuity during times of crisis. The consequences of natural disasters, conflict, climate change and epidemics often disrupt teaching and learning. Including risk reduction in education planning is among the strategies to address this challenge. Technology has the potential to contribute to that goal by helping assess risk, implementing distance learning and assessment, and continuing teachers' professional development during times of crisis.

Goal 5: Education system effectiveness

Digital technology offers significant potential to achieve goals related to education governance through better management, planning and monitoring. However, the success of such technologies depends on the establishment of effective standards, processes and organizational frameworks. Capacity building and coordination of education stakeholders' expertise and resources are key for maximizing the benefits of technology in education administration.

ANNEX 2: THE RELATIONSHIP BETWEEN TECHNOLOGY AND EDUCATION SYSTEM RESILIENCE

Building resilient education systems is a core objective of GPE's approach.[95] Within the context of integrating technology in education, building resilience is understood as the capacity of education institutions to withstand crises and adapt to ensure uninterrupted education service delivery (see box 7).

Various crises have negatively impacted education systems across the world, particularly in low- and middle-income countries. Education has been disrupted by crises for an estimated 224 million children.[96] The COVID-19 pandemic globally affected the schooling of 1.6 billion children, accelerating the transition to blended learning whereby a mix of digital and nondigital technologies were used to support more equitable and inclusive learning continuity (see box 7 for examples of GPE's response to the pandemic). Furthermore, climate-related crises are expected to increase in the future, making it essential to consider the role that technology plays in building climate-smart education systems.

Data-driven and crisis-sensitive planning is critical to fostering system resilience and responding quickly to different disruptions. In contexts of acute and protracted crises, technology can positively contribute to the resilience of education systems through the provision of data-driven, cost-effective and scalable interventions that can ensure the continuity of access to contextually relevant education through all phases of an emergency response (prevention, preparedness, response and recovery). When appropriately integrated into national EMIS, technology can support the systematic collection of data, which can inform decision making on disaster risk mitigation measures, strengthen coordination and

help establish early warning systems to detect risks faced by schools, students, teachers and other education actors.

Furthermore, technology can support the ability of education systems to effectively respond to the unique needs of crisis-affected learners through targeted emergency education programming. Technology-driven platforms have proven effective in implementing accelerated and learning recovery programs as well as psychosocial well-being interventions. Conflict-sensitive and culturally appropriate digital content is particularly critical in ensuring education contributes to notions of peacebuilding and social cohesion.[97]

Ensuring learning continuity in times of crisis requires resilient teachers and multimodal digital solutions supported by strategic partnerships. While digital infrastructure, connectivity and content are needed to build system resilience, teacher capacity and skills to adapt and use the tools are central to build on for the future. Lessons drawn from the education response to the COVID-19 pandemic have shown that the highest tech solutions are not always the best ones to foster resilience in the most challenging contexts.[98] Phone instructions have proven to be very effective to teach students basic numeracy skills during the pandemic.[99] Building partnership to ensure teachers and students have access to the most affordable technology, such as mobile phones, is critical to build resilience into education systems.

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95. GPE, *GPE 2025 Strategic Plan*.
96. ECW, *Crisis-Affected Children and Adolescents in Need of Education Support*.
97. Traxler et al., *Learning through the Crisis*.
98. Tammi, Atis, and Vivekanandan, "Adapt and Learn".
99. Angrist et al., "Building Resilient Education Systems".

BOX 7. GPE'S INVESTMENTS IN TECH4ED TO SUPPORT SYSTEM RESILIENCE

In response to the COVID-19 pandemic, GPE has provided $500 million to 66 partner countries. Over a third of the grants include low-tech distance learning solutions such as radio and TV, while roughly a quarter include online solutions via mobile phone, tablets or web platforms.[a]

GPE support enabled partner countries to foster system resilience through investments in context-relevant technology-driven platforms. In Ethiopia, radios were used to support remote learning, while in Nicaragua school directors and teachers were trained to help deliver digital learning, alternative learning and socio-emotional programs. In Ghana, GPE supported the development of the first phase of a state-of-the-art Learning Management System, enabling teachers to create supplementary content and deliver online instruction. In Pakistan, GPE supported an ambitious hybrid learning program using low- to high-tech solutions to ensure 53,000 students in Balochistan who were previously out of school accessed education, while all the districts in Sindh were strengthened to collect data and monitor teacher presence using technology.

a.   Newman et al., *Summative Evaluation of GPE's COVID-19 Response*.

ANNEX 3: OVERVIEW OF LESSONS LEARNED FROM THE CASE STUDIES ABOUT THE KEY PILLARS OF EDUCATION DIGITAL TRANSFORMATION

Coordination and Leadership:

> Country ownership plays a critical role, which implies the development of comprehensive regulatory frameworks while ensuring their operationalization in the education sector at the national, subnational and school levels.

> Successful Tech4Ed initiatives require robust and innovative partnerships with many actors:
> - Development partners and donors willing to play pivotal roles in providing financial and technical assistance for education reforms, infrastructure improvement and the integration of technology.
> - Private sector stakeholders, focusing on industry collaborations and community-driven projects, with the expertise to shape context-specific Tech4Ed initiatives.
> - Local communities and grassroots institutions to ensure their involvement in the governance architecture and bridge the gap between legislation, policies, implementation, adoption and utilization of technology.

Connectivity and Infrastructure:

> Mapping of school connectivity, monitoring and evaluation are crucial to improve cost efficiency and assess the impact of enhanced connectivity on educational outcomes and to identify areas for further improvement. This involves collecting and analyzing data on various aspects of digital learning to inform future strategies and investments.

> Strategic partnerships that involve collaborating with various stakeholders, including governments and private entities, are essential for enhancing connectivity and infrastructure.

> Regular maintenance and modernization of digital infrastructure are necessary to keep pace with technological advancements and ensure scalability.

> Digital literacy training—that is, providing educators and students with the skills to effectively use digital tools—is vital for maximizing the benefits of internet connectivity in education.

Content and Solutions:

> The success of educational initiatives is contingent on the effective alignment of content and pedagogy. Technology should complement pedagogical goals for a holistic learning experience.

> Continuous teacher training is fundamental to keep pace with evolving technology. Beyond basic digital literacy, educators require advanced skills for effective tech integration. Equipping teachers with these competencies enables them to create dynamic and engaging learning environments that maximize the potential of digital tools.

> Customizing content and pedagogical approaches to meet students' educational needs not only enhances the relevance of educational material but also fosters inclusivity and cultural sensitivity.

Cost and Sustainability:

> Education ministries alone do not have adequate resources to cover the cost of digital transformation. The latter requires collaboration between various sectors and stakeholders to apply all the critical elements of digital transformation.

> A combination of funding modalities is required to support digital transformation. However, clear estimates of the total costs of digital transformation need to be established before making deployment plans.

> Efficiency and equity should be at the center of sustainable financing of EdTech to help narrow the digital divide.

> A clear strategy to mobilize expertise at national, regional and regional level can help offset the cost of digital.

Capacity and Culture:

> Successful deployment of technology requires skilled educators across the education system. It also requires a strategy to nurture a supportive and conducive environment for technology adoption and use.

> Prioritizing hands-on training and interactive learning experiences is essential for the effective integration of technology in classrooms. Engaging educators in experiential learning opportunities can enhance their digital literacy skills and confidence in utilizing digital tools effectively.

> Government-led initiatives play a pivotal role in driving the adoption of technology, while sensitizing and engaging stakeholders at all levels is critical for the successful implementation of Tech4Ed initiatives. Fostering partnerships between government agencies, educational institutions, private companies and community organizations can ensure collective ownership and sustainable change.

Data and Evidence:

> Clear strategies and standards for effective technology integration are a necessary step for effective digital transformation. Integrating technology in line with optimal procedures and processes in EMIS improves efficiency.

> Local adoption of processes and standards helps tailor and deploy technology to fit the specific needs of the education system.

> A well-thought-out and balanced collaboration between human and technological resources enhances education system effectiveness.

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