Advancing SDG 4: Digital Textbooks for Russian Pupils (Grades 6-11): Bridging the Digital Divide - From Digital Inequality to Digital Maturity

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Abstract

This paper investigates the potential of digital textbook readers to enhance education for students in grades 6-11 in Russian schools, aiming to bridge the digital divide and promote sustainable development. It explores how e-books can improve learning outcomes, their economic implications for schools and families, and the policy framework necessary for their effective implementation. The study utilizes a comprehensive review of recent literature, a cost-benefit analysis to assess the impact of transitioning from traditional paper textbooks to e-books.

Literature review suggests that while e-books can significantly enhance educational quality, reduce long-term costs, and minimize environmental impact, addressing infrastructure and policy challenges is crucial for their success. The paper comes up with a policy formulation in terms of the best gadget for electronic books. It provides recommendations for the Russian Ministry of Education, including a phased approach exploring alternative e-reader options due to Amazon's withdrawal from the Russian market, and complementary strategies such as establishing digital libraries and fostering partnerships. By addressing the digital divide and investing in digital literacy initiatives and strategic technology integration, Russia can create a more equitable, accessible, and effective education system that prepares students for the digital age.

Keywords: Digital Textbooks, Digital Divide, Education Policy, Russia, Cost-Benefit Analysis

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การส่งเสริม SDG 4: ตำราเรียนดิจิทัลสำหรับนักเรียนรัสเซีย (ชั้นประถมศึกษาปีที่ 6-11): การเชื่อมช่องว่างทางดิจิทัล - จากความเหลื่อมล้ำทางดิจิทัลสู่ความเป็นผู้ใหญ่ทางดิจิทัล

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บทคัดย่อ

บทความนี้สำรวจศักยภาพของตำราเรียนดิจิทัลในการเพิ่มพูนการศึกษาสำหรับนักเรียนในระดับชั้น 6-11 ใน โรงเรียนรัสเซีย โดยมีเป้าหมายในการเชื่อมช่องว่างทางดิจิทัลและส่งเสริมการพัฒนาที่ยั่งยืน ศึกษาว่าหนังสืออิเล็กทรอนิกส์สามารถปรับปรุงผลการเรียนรู้ได้อย่างไร ผลกระทบทางเศรษฐกิจที่มีต่อโรงเรียนและครอบครัว และกรอบนโยบายที่จำเป็นสำหรับการนำไปใช้ที่มีประสิทธิภาพ การศึกษาใช้การทบทวนวรรณกรรมล่าสุด อย่างครอบคลุม การวิเคราะห์ต้นทุน-ผลประโยชน์ และการสร้างแบบจำลองทางการเงินเพื่อประเมินผล กระทบของการเปลี่ยนจากตำราเรียนแบบดั้งเดิมไปสู่หนังสืออิเล็กทรอนิกส์ ผลการศึกษาชี้ให้เห็นว่าแม้ว่า หนังสืออิเล็กทรอนิกส์จะสามารถเพิ่มคุณภาพการศึกษา ลดต้นทุนระยะยาว และลดผลกระทบต่อสิ่งแวดล้อม ได้อย่างมีนัยสำคัญ แต่การแก้ไขปัญหาโครงสร้างพื้นฐานและความท้าทายด้านนโยบายเป็นสิ่งสำคัญสำหรับความสำเร็จ บทความนี้ให้คำแนะนำโดยละเอียดแก่กระทรวงศึกษาธิการของรัสเซีย ซึ่งรวมถึงการดำเนินการตามแนวทางแบบค่อยเป็นค่อยไปพร้อมกับโครงการนำร่อง การสำรวจทางเลือกอื่นสำหรับอีรีดเดอร์ เนื่องจาก การถอนตัวของ Amazon ออกจากตลาดรัสเซีย และกลยุทธ์เสริมอื่น ๆ เช่น การจัดตั้งห้องสมุดดิจิทัลและ ส่งเสริมความร่วมมือ โดยการแก้ไขช่องว่างทางดิจิทัลและการลงทุนในโครงการการรู้หนังสือดิจิทัลและการบูรณาการเทคโนโลยีเชิงกลยุทธ์ รัสเซียสามารถสร้างระบบการศึกษาที่มีความเสมอภาคเข้าถึงได้ และมีประสิทธิภาพมากขึ้น ซึ่งเตรียมความพร้อมให้นักเรียนสำหรับยุคดิจิทัล

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Introduction

Russian Education in the 21st Century: Challenges and Opportunities

The Soviet educational system was perhaps the best in the world, particularly in sciences like math, physics, chemistry, and engineering as evidenced by the Space Race. However, the sudden collapse of the USSR in 1991 triggered a profound crisis in Russian education, marked by declining teacher salaries, reduced class sizes, and as a consequence loss of prestige for the profession. The government's withdrawal from the sector forced it into a state of self-preservation, detached from the evolving needs of the nation. This isolation led to outdated curricula and a failure to equip students with essential skills for the 21st century, such as computer science, language proficiency, and social sciences. Russia's education system, despite producing a high percentage of university graduates, faces significant challenges that impact its global competitiveness. The consequences of this neglect are evident in the declining knowledge levels of first-year university students and the growing concerns of employers regarding the quality of the workforce. Although Russia outperforms Europe in human capital development, it is rapidly losing its competitive edge. The 2015 Human Capital Report ranked Russia 26th out of 124 countries, highlighting weaknesses in educational quality and health outcomes. The 2018 PISA study by the OECD indicated that in Russia 15-year-old students scored lower than the OECD average in reading and science and about the same in mathematics. There have been no PISA results on Russia since 2022 due to Ukrainian conflict. In Russia and across the world "the COVID-19 pandemic exposed [these] shortcomings and underlined the need for supportive policies and conditions to make use of the full potential of digital technologies in education", according to the 2023 OECD report titled Shaping Digital Education: Enabling Factors for Quality, Equity, and Efficiency.

The demographic trends in Russia indicate a significant increase in the number of school- aged children. According to government agency Rosstat, at the beginning of the 2022-2023 school year, there were more than 17.7 million schoolchildren in Russia. More than 1 million teachers were involved in their education in schools. Projections estimate that by 2025, the number of schoolchildren will increase by 3.6 million.

To accommodate this growth, the government has pledged to develop a program for building new schools. Currently, the number of schools has increased from 43.7 thousand to 44 thousand. Given these trends, there will be approximately 16 million pupils distributed over 11 grades. As of August 2015, the Minister of Education and Science, Dmitry Livanov, confirmed that all Russian schools were connected to the internet. High-speed internet was available in 70% of urban schools and 20% of rural schools. Despite these advancements, a national average of one computer per 12-16 students indicates that Russia lags behind other countries.

At the beginning of 2024, Russia had 130.4 million internet users, representing an internet penetration rate of 90.4%. Additionally, there were 106.0 million social media users in the country, making up 73.5% of the total population but studies revealed stark disparities in ICT access and usage across different demographics in Russia. For instance, research in Russia indicates that students who do not use the internet often come from families with lower educational attainment and income levels. Globally, individuals with higher education are significantly more likely to have home computers and internet access compared to those with lower educational levels (Freiberg, 2012). But the digital divide is not a static phenomenon. While overall access to ICTs is increasing, certain groups, such as low-income individuals are being left behind at a faster rate. This trend is particularly concerning in the context of education, as ICTs have become integral to teaching and learning.

The Russian government understands that revitalization of education is crucial for improving academic outcomes and developing a skilled workforce that can drive innovation and economic growth. More over these policies are aimed at achieving sustainable Development Goal 4- ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all. There is also clear understanding that no achievement these days can be accomplished without technology, be it economy, medicine or education. In the 21st century digital technology holds the key to success in any sphere. While technology can be applied in various ways throughout the educational process, one of the clearest ways is though digital materials, i.e. textbooks and supplementary multimedia materials.

In Russia the legal framework plays a key role in implementing digital textbooks and resources, ensuring standardized quality across institutions through the use of federally approved materials. The Constitution and the Law "On Education" guarantee free access to primary, basic, and secondary education. The Federal Law of December 29, 2012, N 273-FZ, reinforces this right by providing state-funded educational resources. Since January 1, 2014, the procurement of educational materials has been governed by Federal Law N 44-FZ, requiring the use of only federally approved textbooks for state-accredited programs. Article 35 of the Federal Education Act guarantees students free access to these resources, funded by a combination of federal, regional, and local budgets. In December 2014, the Russian Ministry of Education mandated that all approved textbooks be available in both print and electronic formats to modernize the learning experience. Pilot programs in 25 regions showed that electronic textbooks, which include multimedia elements, improved student performance by nearly 30 percent. These digital resources, accessible on various devices, are designed to complement traditional textbooks, providing students and parents with more options.

These amendments to the federal list of textbook requirements stipulated that each textbook must have an electronic version available in popular formats without licensing restrictions. These digital versions had to be compatible with multiple operating systems, including those for mobile devices, and incorporate multimedia and interactive elements that enhance the learning experience. On December 2, 2021 the Government of the Russian Federation approved a strategic direction for digital transformation in education, aiming to enhance the digital infrastructure and resources across educational institutions. This strategy, initially guided by the now- revoked Order No. 3427-r, focuses on integrating advanced technologies such as artificial intelligence, big data, distributed registry systems, and cloud technologies into the educational framework.

Therefore, the primary objective of digital transformation in Russia (as envisioned by its government) is to provide effective information support to participants in educational relations, facilitating the education process and managing educational

activities more efficiently. The strategic direction involves several implementation phases, focusing on integrating Russian-origin radio-electronic products and creating a comprehensive electronic information and educational environment. By 2030, the objective of the Russian Federation is to achieve *"digital maturity"* in education, aligning with national development objectives and increasing investment in domestic information technology solutions.

Policy Problem: Addressing the Digital Divide and the Transition to E-Textbooks in Russian Education

To achieve the above mentioned *"digital maturity"* in education by 2030, Russia must overcome the digital divide that is currently being exacerbated by the push for digital textbooks. This divide is due to several factors, including Russia's lag in e-book adoption, wealth disparities among families. This policy disproportionately benefits children from affluent families who can afford tablets, creating an unfair advantage over those from lower- income households. While providing tablets or laptops to all students could mitigate this issue, that is considered to be not financially feasible and would entail significant costs for the Russian state. Additionally, concerns exist about excessive screen time for children and the impracticality of using tablets for subjects that require extensive reading, such as literature. Excessive screen use in children has been linked to several potential eye health issues, including myopia (near-sightedness) and digital eye strain. Research indicates that the rise in myopia prevalence may be partly attributed to increased near-work activities, including both screen time and traditional reading. The World Health Organization has recognized the importance of sleep and has included it in their recent recommendations for children's health. While the American Academy of Ophthalmology has not issued specific guidelines regarding screen time limits for children, it is crucial for parents to be aware of these potential risks and ensure that their children engage in healthy screen use habits, including taking regular breaks and avoiding screen time before bed, according to the American Academy of Ophthalmology (2024).

Benefits of Digital Devices in Education

The sustainable development of modern society, primarily driven by information and communication technologies (ICT), is increasingly emphasized in global discourses. As we progress into the digital age, ICT stands as a significant indicator of a country's development and progress. The integration of ICT in education, particularly through the introduction of digital textbooks, represents a transformative approach to traditional educational practices.

Various studies have demonstrated the potential benefits of digital textbooks. They can significantly enhance student engagement, facilitate access to up-to-date information, and support differentiated instruction tailored to individual student needs.

Overall access to and proper use of ICTs are essential for success in the information society. Those who adopt and harness new technologies gain a significant advantage, fostering professional growth and prosperity. Conversely, those on the wrong side of the digital divide face potential unemployment or relegation to manual labour. The opportunities provided by modern digital technologies are vast, but only a fraction of the global population can leverage them for social and economic advancement. This dichotomy mirrors the transformative impact of the Industrial Revolution and the invention of the printing press, with ICTs driving profound changes in how societies function and individuals thrive.

Researchers unanimously agree that ICT is a formidable force in driving economic, social, political, and educational reforms. Developing nations must embrace ICT to remain competitive in the global economy. The rapid evolution of ICT introduces new possibilities for teaching and learning, with models for integrating technology in education continuously refined (OECD, 2023). The integration of ICT in education is crucial for social mobility, especially for low-income children. Digital skills now encompass not just the ability to operate hardware and software (instrumental skills), but also the ability to search, select, process, and apply information from digital sources (informational skills), and strategically use this information to improve one's societal position (OECD, 2023). Moreover, the OECD report emphasizes

that digital technology should prioritize learning outcomes rather than just increasing digital inputs.

Research Objective

Therefore, this study aims to formulate and recommend a Russian Federation government policy towards the procurement of digital devices for pupils in grades 6-11 to be used with electronic versions of the textbooks. This policy will focus on digital technology that could potentially augment education, while limiting pupils' distraction, while being financially feasible. The OECD (2023) report cautions against the negative impacts of excessive or inappropriate ICT use. Data from large-scale assessments like PISA show a negative correlation between excessive ICT use and student performance. In 14 countries, even the mere presence of a mobile device was found to distract students and hinder learning, yet fewer than one in four countries have banned smartphone use in schools.

Methodology

To formulate an appropriate policy addressing the digital divide in Russian education, this study employs a mixed-methods approach. The research commences with an extensive literature review, examining the global landscape of digital technology in education, with a specific focus on the challenges and opportunities associated with the digital divide and the use of digital devices. The review identifies prevailing trends and best practices, which serve as a foundation for formulating the policy's objectives and strategies.

Since Russia is an authoritarian state, any policy should be formulated and approved by the Kremlin. The top-down approach, also known as forward mapping, posits that policy implementation begins with a decision made by the central government (Seraw&Lu, 2020). This method focuses on the goals set by high-level policymakers and traces the design and implementation of the policy down through the lowest-level implementers (Birkland, 2015). It uses the decisions of central authorities as a starting point, considering factors such as problem tractability, the ability to structure implementation, and non-statutory variables that might

affect the process. Top-down models often recommend that governments set clear, reliable goals, limit the extent of necessary changes, and assign implementation responsibility to an agency aligned with the policy's objectives (Signé, 2017). According to Birkland (2015), the top-down approach relies on several critical assumptions: policies must have clearly defined goals and tools for achieving them, a single authoritative policy statement must exist, and the policy implementation is viewed as a chain starting from the top. It also assumes that policymakers have a good understanding of the commitment and capacity of implementers, which includes resources such as funding, legal authority, and expertise

Therefore, a range of policy alternatives is identified, each designed to address the digital divide and enhance educational outcomes. These alternatives are then systematically evaluated against a set of predefined criteria, including cost-effectiveness, device suitability, technical support requirements, equity considerations, and sustainability implications. A decision-making matrix is employed to facilitate a structured comparison of the alternatives against the objectives, ensuring transparency and rigor in the selection process.

This research also incorporates a comprehensive cost-benefit analysis to assess the economic implications of each alternative, considering both direct and indirect costs. This analysis aids in determining the financial feasibility and long-term sustainability of each option.

Furthermore, this study examines relevant Russian normative acts to ensure that the proposed policy recommendations align with the existing legal framework governing education and technology. This analysis ensures that the policy is not only grounded in research but also adheres to regulatory requirements.

Finally, this research culminates in a policy proposal that outlines the recommended course of action for the Russian government. This proposal is informed by the findings of the literature review, the evaluation of alternatives, the cost-benefit analysis, and the analysis of normative acts. It provides a clear and actionable plan for bridging the digital divide and leveraging digital technology to enhance the quality and effectiveness of education in Russia.

Data Collection and Analysis

The study initiates its exploration with a systematic and extensive literature review, encompassing a wide array of academic sources, policy reports, and statistical data pertaining to the digital divide, the utilization of digital devices in education, and the implementation of e-textbooks on both global and Russian scales. The review critically examines existing research to extract key insights and trends, forming a foundation for the subsequent analysis.

To provide a contextualized understanding, the research incorporates recent news and statistical data specific to Russia. This data sheds light on the current state of digital access and usage within the Russian educational landscape. The study employs descriptive statistics to offer a quantitative perspective on these trends, acknowledging that these figures serve as estimates rather than precise measurements. The research further integrates relevant statistical data on Russian education, encompassing textbook usage and technology adoption, sourced from reputable national organizations. The inclusion of this data adds depth and empirical support to the analysis. A critical component of the methodology is a rigorous cost-benefit analysis, employed to evaluate the economic implications associated with the transition from traditional textbooks to e-books. This analysis encompasses both direct costs, such as device procurement and keeps in mind indirect costs such as teacher training and infrastructure development. By conducting this comprehensive cost-benefit analysis, the research aims to provide a holistic assessment of the financial feasibility and long-term sustainability of various policy alternatives aimed at bridging the digital divide.

Furthermore, the research burrows into an examination of Russian normative acts, meticulously analysing the legal framework that governs the implementation of digital textbooks and resources within the country. This analysis ensures that the proposed policy recommendations are not only grounded in research but also align seamlessly with existing regulations, thereby promoting a standardized and equitable quality of education across all educational institutions.

Limitations

The findings presented in this work may not be generalizable to all regions of Russia due to variations in infrastructure and socio-economic conditions. Additionally, due to space limitations, this paper cannot provide an exhaustive overview of the complex issue of the digital divide in Russia. The data collected from various sources may present inconsistencies, and interpretations can be subjective. Furthermore, the dynamic nature of the topic and ongoing academic discussions make it challenging to apply established theories and constructs.

Literature Review

The literature review encompasses a diverse array of sources, totalling 41, drawn from 16 journals and 5 books, spanning from 1999 to 2023. This extensive body of work represents research conducted or focused on over 20 countries, including Nigeria, India, Russia, Mexico, and Vietnam, reflecting a global perspective on the integration of Information and Communication Technology (ICT) in education. The aim of this literature review was to understand whether ICT in education, particularly tablets and readers are a benefit or a distraction, as well to uncover and suggestions in the best way to implement them in the educational process.

International Cases

There are numerous approaches to technology in education across the world, and these approaches are not stationary. Here in Thailand in 2023, the Thai Ministry of Education under Minister Permpoon Chidchob announced plans to revive the "one student, one tablet" program. This initiative, originally launched in 2011 under former Prime Minister Yingluck Shinawatra, aims to provide all students and teachers with tablet computers to promote educational equity. The program, which initially distributed tablets to 860,000 first-grade students with a budget of 1.7 billion baht, was terminated in 2014 following a military coup. We have yet to see what the current government of Paetongtarn "Ung Ing" Shinawatra the 31st prime minister of Thailand will continue this 'populist' policy of her predecessors.

Sweden is undergoing a significant shift in its educational approach, moving away from its previous emphasis on digital learning tools. Concerns about a decline in basic skills, possibly exacerbated by the pandemic and an increase in non-native Swedish speakers, have prompted the government to promote traditional methods such as textbooks and handwriting. This move is supported by some experts who cite studies suggesting that digital tools may hinder rather than enhance learning. However, critics argue that this shift is politically motivated and lacks substantial evidence, emphasizing the need for a nuanced understanding of technology's role in education.

Similarly, California has reinstated cursive handwriting into its elementary school curriculum. Starting this 2024, pupils in grades one through six will be taught handwriting, with cursive lessons specifically mandated from third grade onwards. This decision marks a shift back to traditional handwriting instruction after years of prioritizing keyboard typing skills. Proponents of the change argue that cursive writing benefits brain development, reading ability, and motor skills. Moreover, it allows children to access historical documents and personal letters from previous generations.

In contrast, Poland is actively embracing technology, providing students with government- funded laptops to enhance their technological competitiveness. The United States, on the other hand, adopts a hybrid approach, utilizing both print and digital resources due to disparities in internet access across the country. This approach acknowledges that while technology can be a valuable tool, it's crucial to ensure equitable access for all students.

Germany, known for its slower adoption of technology in various sectors, also demonstrates a cautious approach to integrating digital tools in education, with varying levels of implementation across its different states.

In Peru, distributing over 1 million laptops without integrating them into pedagogy did not enhance learning outcomes. Conversely, in China, high-quality lesson recordings delivered to 100 million rural students improved educational outcomes by 32% and reduced urban-rural earning gaps by 38%.

Potential Benefits

The literature highlights the multifaceted role of ICT in education, emphasizing its potential benefits and the challenges that need to be addressed to harness its full potential. The literature review identifies five key themes regarding the integration of ICT in education:

1. The Multifaceted Potential of ICT in Education: The literature underscores the diverse ways in which ICT can enhance education, such as boosting learner motivation and engagement, facilitating the acquisition of new skills, and improving teacher training, which ultimately fosters economic and social development (Rajesh, 2003; Mbodila et al., 2013; Hawkins, 2002). Moreover, ICT can democratize education by providing access to learners in diverse contexts, bridging gaps in rural education, and promoting various forms of participation (Rajesh, 2003; Winthrop & Smith, 2012).

2. The Importance of Sustainable Development and Skill Acquisition: The literature recognizes the role of ICT in promoting sustainable development by fostering skills essential for the digital age, such as software development and networking. However, it also acknowledges the challenges associated with ICT integration, including maintenance issues and budget constraints (Mikre, 2011; USAID, 2011; Hawkins, 2002; Kozma, 2010; Jhurree, 2005; Tarimo, n.d.; Winthrop & Smith, 2012).

3. The Need for Comprehensive Planning and Resource Allocation: The successful integration of ICT in education necessitates meticulous planning, substantial investment in infrastructure, and the allocation of adequate resources to implement and sustain effective programs. This includes the development of innovative pedagogies and assessment methods that leverage the potential of technology (Hawkins, 2002; Kozma, 2010; Dahlman, 2007; Peeraer & Van Petegem, 2011).

4. The Crucial Role of Teacher Training and Development: The literature consistently emphasizes the pivotal role of teacher training and development in realizing the full potential of ICT in education. Continuous professional development

opportunities for educators are essential to equip them with the necessary skills and knowledge to effectively integrate technology into their teaching practices and adapt to the evolving demands of the digital age (Mbodila et al., 2013; Hawkins, 2002; Kozma, 2010; Jhurree, 2005; Peeraer & Van Petegem, 2011).

5. Addressing Challenges and Ensuring Equity: While acknowledging the transformative potential of ICT in education, the literature also recognizes the challenges and potential pitfalls associated with its implementation. These challenges include policy issues, infrastructure deficiencies, the digital divide, and the risk of reinforcing existing inequalities if ICT is not tailored to specific needs (Martinez-Frias, 2003; Mikre, 2011; Jhurree, 2005;). The literature advocates for a balanced and nuanced approach that prioritizes equity, accessibility, and the development of context-specific strategies to ensure that all learners can benefit from the opportunities offered by ICT.

All in all, the tangible impact of these innovations on classroom practices can be slow to materialize. While few countries, such as Malaysia, have effectively used technology to enhance their education systems, delaying the adoption of ICT can hinder the necessary transformation of schools and educational practices. Overall, scholars remain divided on whether the digital age heralds a new era of enlightenment or a period of increased division and reduced democratic engagement. Evgeny Morozov (2011) writer, researcher, and intellectual from Belarus who studies political and social implications of technology highlights the historical pattern of new technologies being seen as democratizing forces, often falling short of such expectations.

Potential Challenges

The following themes emphasize the complex role of ICT in education, showcasing its potential benefits while underscoring the challenges that need to be overcome for successful technological integration to enhance educational outcomes. The synthesis of ideas from researchers reveals five recurring themes:

1. The Complex Impact of ICT on Education and the Digital Divide: The literature presents a nuanced perspective on the impact of ICT in education. While researchers like Rajesh (2003), highlight the potential of ICT to enhance learning, motivation, and skill acquisition, others, such as Morozov (2011) and the OECD (2023), caution against technocratic optimism. They emphasize the need to address persistent inequities and the potential for technology to reinforce existing divides. The framing of the digital divide and the language used to discuss it can significantly influence public support for ICT initiatives (Mansell, 2010; Kelley- Salinas, 2000).

2. The Importance of Teacher Training and Pedagogical Considerations: The literature consistently underscores the critical role of teachers in the successful integration of ICT in education. The need for comprehensive teacher training, continuous professional development, and the development of new pedagogies and assessment methods is emphasized by researchers such as Mbodila et al. (2013), Hawkins (2002), Kozma (2010), and Jhurree (2005). The OECD (2015) report further highlights the importance of educator proficiency in using technology and adapting pedagogical approaches to maximize the benefits of ICT.

3. The Need for Comprehensive Planning, Infrastructure, and Resources: Effective and sustainable integration of ICT in education requires careful planning, investment in infrastructure, and the allocation of adequate resources. Researchers Hawkins (2002) and Kozma (2010) stress the importance of addressing challenges related to maintenance, budget constraints, and the development of appropriate infrastructure and support systems. The literature also emphasizes the need for context-specific strategies and long-term commitment to ensure the success of ICT initiatives (Mndzebele, 2013).

4. The Role of Empirical Evidence and Clear Objectives: The literature highlights the importance of empirical evidence and clear learning objectives in guiding the effective use of ICT in education. Studies demonstrate that while ICT can improve student achievement under certain conditions, its effectiveness is diminished when learning objectives are unclear or when technology is used excessively or inappropriately. The OECD (2023) report cautions against the negative impacts of

excessive or inappropriate ICT use and emphasizes the need to prioritize learning outcomes over digital inputs.

5. Addressing Challenges and Inequalities: While ICT holds immense promise for transforming education, the literature acknowledges the potential challenges and inequalities associated with its implementation. Issues such as policy barriers, infrastructure deficiencies, the digital divide, and the potential for technology to reinforce existing inequalities are highlighted by researchers like Martinez-Frias (2003) and Mikre (2011) literature calls for nuanced approaches that address both material and social inequalities, ensuring equal access and quality learning opportunities for all students.

Therefore, while digital textbooks and ICT in education offer numerous benefits, their implementation must be carefully considered to address challenges such as the digital divide, unequal access, and the potential negative impacts of excessive technology use. Effective integration of ICT requires a solid educational foundation, informed decision-making, and continuous evaluation to ensure that technology serves as a complement to traditional educational practices and promotes quality and equity in education.

Understanding the Digital Divide and Strategies for its Mitigation

The above literature review clearly indicates that incorrectly implemented government policy in regards to technology in education leads to a phenomenon called the digital divide. The digital divide refers to the disparity in access to and use of information and communication technologies (ICTs), creating an uneven distribution of opportunities and advantages within society. This divide manifests at various levels, including international, national, and societal, with profound implications for social development, economic growth, and educational equity.

Research on the digital divide has identified several key dimensions:

1. Access: This dimension focuses on physical access to devices like computers, tablets, and smartphones, as well as reliable internet connectivity.

Socioeconomic status, education level, race, gender, and geographic location are among the factors that influence access to ICTs.

2. Usage: While access is a prerequisite, the ability to utilize ICTs effectively is equally important. This dimension encompasses digital literacy, skills in using various applications and software, and understanding the potential benefits of technology.

3. Impact: The impact of the digital divide extends beyond individual users, affecting communities and society as a whole. It can exacerbate existing inequalities, limit social mobility, create barriers to employment, and deepen social exclusion for marginalized groups.

While the issue of the digital divide has been extensively studied in Western literature, providing valuable insights and data the phenomenon is relatively new in Russia, requiring a contextualized approach. In the context of Russia's transition to digital textbooks, addressing the digital divide is crucial to ensure that all students have equal opportunities to benefit from this technological advancement.

To address the digital divide, various strategies have been proposed, and could be applied in Russia.

1. Infrastructure Development: Expanding access to affordable broadband internet and providing computing resources in underserved areas can bridge the access gap.

2. Digital Literacy Training: Educational programs that equip individuals with the skills to use ICTs effectively can enhance their ability to participate in the digital economy and society.

3. Targeted Interventions: Addressing the specific needs of marginalized groups, such as older adults, people with disabilities, and rural communities, requires tailored solutions that consider their unique challenges and barriers.

4. Collaboration between Stakeholders: Governments, educational institutions, businesses, and community organizations must work together to create a comprehensive and sustainable approach to digital inclusion.

It is therefore clear from the above that the digital divide could represent a major challenge for Russian society, particularly in the area of education. By carefully considering these factors, we can select the most appropriate policy alternative to address the digital divide in Russian education and create a more equitable and effective learning environment for all students. To ensure equal access to digital resources and opportunities, this study proposes the following objectives and corresponding strategies to avoid building up digital inequality that would lead to a digital divide:

Objective 1: Mitigate the Digital Divide among Russian School Pupils

Strategies:

- Device Provision: Provide all schoolchildren with devices (e.g., e-readers or tablets) to access e-books both at home and in school.
- Universal Internet Access: Ensure reliable internet connectivity in all schools, regardless of location or socioeconomic factors.
- Digital Literacy Education: Integrate digital literacy training into the curriculum, teaching students how to effectively use e-resources for learning and research.

Objective 2: Bridge the Digital Divide between Russia and Other Countries in the Educational Context

Strategies:

- Digitize Educational Resources: Convert all textbooks, major supplementary texts, and reference materials into digital formats.
- Teacher Training: Provide comprehensive professional development for teachers on integrating digital resources into their instruction.
- Technological Infrastructure: Invest in supplementary technology for schools, such as interactive whiteboards, projectors, and audio-visual equipment.

Objective 3: Enhance the Quality and Effectiveness of the Russian Education Process

Strategies:

- Streamline Resource Management: Transitioning to digital textbooks can reduce costs associated with book writing, printing, delivery, and storage.
- Environmental Sustainability: Minimize the environmental impact of paper production by reducing the reliance on printed materials.
- Health Considerations: Address potential health concerns related to screen time by promoting ergonomic practices and incorporating breaks into digital learning activities.

By pursuing these three objectives and implementing the proposed strategies, Russia can create a more equitable, accessible, and effective education system that prepares students for success in the digital age. This approach will not only bridge the digital divide within the country but also enhance Russia's competitiveness on the global stage.

Alternatives for Addressing the Digital Divide in Russian Education

To bridge the digital divide in Russian schools and ensure equitable access to digital textbooks, the following four alternative gadgets chosen based on their technical characteristics and price are proposed for evaluation.

Alternative 1: Status Quo (Paper Textbooks and Downloadable E-Textbooks)

Description: Maintain the current system where all approved textbooks have accompanying e-book versions available for download on three platforms. Individuals and schools are responsible for procuring their own devices.

Alternative 2: Google Nexus 9 (Tablet Provision and Subsidization)

Description: Provide Google Nexus 9 tablets to students in grades 6-11, replacing them every two years. Resell used devices at 10% of their scrap value. Subsidize 50% of the tablets at 100%, 25% at 50%, and leave the remaining 25% of the cost to parents.

Alternative 3: Asus Transformer Book Flip (Tablet Provision and Subsidization)

Description: Provide Asus Transformer Book Flip tablets to students in grades 6-11, replacing them every two years. Resell used devices at 10% of their scrap value. Subsidize 50% of the tablets at 100%, 25% at 50%, and leave the remaining 25% of the cost to parents.

Alternative 4: Kindle for Kids (E-reader Provision and Subsidization)

Description: Provide Kindle for Kids e-readers to students in grades 6-11, replacing them every two years. Resell used devices at 10% of their scrap value. Subsidize 50% of the tablets at 100%, 25% at 50%, and leave the remaining 25% of the cost to parents.

Table 1: Technical Specifications of Gadgets

	Display	Size	Weight	Storage	Battery	Wi-Fi	System	Sound
Google Nexus 9 $399	8.9 inches (~73.5% screen-to-body ratio) 1536 x 2048 pixels (~281 ppi pixel density)	228.2 x 153.7 x 8 mm (8.98 x 6.05 x 0.31 in)	425 g (Wi-Fi) / 436 g (3G/LTE) (14.99 oz)	16 GB (Wi-Fi)/ 32 GB (LTE), 2 GB RAM	Non-removable Li-Po 6700 mAh battery Up to 720 h (3G) Up to 9 h 30 min (multimedia) (3G)	Wi-Fi 802.11 a/b/g/n/ac, dual-band, Wi-Fi Direct, DLNA, hotspot	Android OS, v5.0 (Lollipop) , upgradable to v5.1.1 (Lollipop)	Yes, with stereo speakers
ASUS Transformer Book T100TA $451	10.1” 16:9 IPS HD (1366x768) with Multi-Touch Screen	Tablet: 263 x 171 x 10.5 mm (WxDxH) Dock: (Mobile Dock) 263 x 171 x 10 mm (WxDxH)	Tablet: 0.55 kg Dock: (Mobile Dock) 0.52 kg Dock: (HDD Dock) 0.60 kg	Memory 2 GB 32GB eMMC 64GB eMMC 32GB eMMC With 500 GB HDD 64GB eMMC) With 500 GB HDD	2Cells 31 Whrs Polymer Battery	Integrated 802.11 a/b/g/n Built-in Bluetooth™ V4.0	Windows 8.1 Pro Windows 8.1	Built-in 2 Speaker(s) And Digital Array Microphone SonicMaster

Table 1: Technical Specifications of Gadgets (continued)

	Display	Size	Weight	Storage	Battery	Wi-Fi	System	Sound
Kindle, 6" Glare-Free Touchscreen Display, Wi-Fi 1 year warranty $50	Amazon's 6" display technology with E Ink Pearl™, 167 ppi, optimized font technology, 16-level gray scale	6.7" x 4.7" x 0.40" (169 mm x 119 mm x 10.2 mm)	6.7 ounces (191 grams)	4 GB; holds thousands of books Free cloud storage for all Amazon content	A single charge lasts up to four weeks, based on a half hour of reading per day with wireless off. Battery life will vary based on wireless usage Fully charges in approximately 4 hours from a computer via USB cable	Supports public and private Wi-Fi networks or hotspots that use the 802.11b, 802.11g, or 802.11n standard with support for WEP, WPA and WPA2 security using password authentication or Wi-Fi Protected Setup (WPS)	Kindle Format 8 (AZW3), Kindle (AZW), TXT, PDF, unprotected MOBI, PRC natively; HTML, DOC, DOCX, JPEG, GIF, PNG, BMP	No

These alternatives will be evaluated on several key considerations deduced from the literature review section.

Key Considerations

Cost-Effectiveness: Each alternative entails different costs for device procurement, replacement, and subsidization. A thorough cost-benefit analysis is necessary to determine the most financially viable option.

Device Suitability: The suitability of each device for educational purposes, including factors like screen size, battery life, and durability, should be carefully evaluated.

Technical Support: Adequate technical support and training for students and teachers are essential for the successful implementation of any digital textbook initiative.

Equity: Consider the impact of each alternative on digital equity, ensuring that all students, regardless of socioeconomic background, have equal access to digital resources and opportunities.

Sustainability: Evaluate the environmental impact of each alternative, including the energy consumption and waste generation associated with device production and disposal.

Analysis of Alternatives

Alternative 1: Status Quo (Paper Textbooks and Downloadable E-Textbooks)

Objective 1: Avoiding Digital Divide Among Russian School Pupils

The primary objective of this objective is to prevent a digital divide among Russian school pupils by ensuring access to e-gadgets and state-approved educational materials. Currently here will be approximately 17.7 million pupils distributed over 11 grades, requiring around 8.7 million gadgets for grades 6-11. However, under the status quo, no new gadgets will be provided.

Objective 2: Bridging the Digital Divide Between Russia and Other Countries

This Objective focuses on bridging the digital divide between Russian schools and those in other countries by ensuring internet connectivity and access to digital devices. But outdated equipment and insufficient personal devices among students exacerbate the divide.

Objective 3: Improving the Quality and Effectiveness of Russian Education

Through Technology. The current situation limits the availability of e-books only and exclusively to students whose parents can afford the necessary devices or to schools with adequate computer resources. This perpetuates the digital divide and maintains reliance on outdated paper textbooks, which are costly to produce and distribute. This approach also has environmental implications, such as deforestation. Therefore, without new interventions, the quality and effectiveness of the education process will remain suboptimal.

Analyzing the alternative 1 in relation to the stated objectives, we can assess its compatibility using key considerations:

1. Cost-Effectiveness

The status quo alternative avoids immediate significant investments in new devices, which might seem cost-effective at first glance. However, relying on outdated paper textbooks and a limited number of available devices can lead to hidden costs over time, such as the continuous production and distribution of paper materials, which are expensive and environmentally taxing. The lack of new gadget provision under this alternative also means missed opportunities for modernizing education, which could result in long-term economic inefficiencies.

2. Device Suitability

Under the status quo, device suitability remains a significant issue. Many students rely on either personal devices, which vary widely in quality and appropriateness for educational use, or on outdated school computers. These devices often lack the necessary features for effective learning, such as adequate screen size, battery life, and durability. Without new investments, the mismatch between device capabilities and educational needs will persist, hampering the overall learning experience.

3. Technical Support

The status quo offers limited advancement in technical support. As the reliance on outdated technology continues, the burden on existing technical support systems will grow, potentially overwhelming the ability to provide effective assistance to both students and teachers. The lack of new devices also means fewer opportunities for training on up-to-date technology, which is crucial for the successful adoption of digital textbooks.

4. Equity

This alternative does little to address digital equity. Students in wealthier families or better- funded schools will continue to have better access to digital resources, while others remain disadvantaged. The current approach perpetuates the digital divide, both within Russia and in comparison with other countries, as access to modern educational tools is unevenly distributed. This inequity could have long-lasting effects on the educational outcomes and future opportunities for students from lower socioeconomic backgrounds.

5. Sustainability

The environmental impact of the status quo is concerning. The continued use of paper textbooks contributes to deforestation and other environmental issues related to the production and disposal of paper. Additionally, the limited push towards digital alternatives means that the potential sustainability benefits of reducing paper use are not realized. Without new interventions, the status quo maintains a higher environmental cost compared to a more digital-focused approach.

Outcome of Alternative 1

The status quo alternative is generally incompatible with the objectives of bridging the digital divide, improving education quality, and ensuring sustainability. While it may appear cost- effective in the short term, it fails to address the growing needs of the student population, the suitability of educational devices, and the equitable distribution of resources. To meet these objectives effectively, a more proactive approach involving investment in new technology and comprehensive support systems is necessary.

Alternative 2: Providing Russian Pupils with Google Nexus 9 - 16 GB

Objective 1: Avoiding Digital Divide Among Russian School Pupils

Providing Google Nexus 9 tablets would ensure all children have access to internet materials and educational resources. With 16 million pupils across 11 grades,

8.7 million gadgets are needed immediately. At $399 per device, the cost would be approximately $3.48 billion, a substantial expense that the state is unlikely to afford. This expenditure would need to be repeated every two years, further complicating the financial feasibility given the current weakness of the Russian ruble against the USD.

Objective 2: Bridging the Digital Divide Between Russia and Other Countries

This alternative would address the digital divide by equipping Russian schools with modern devices, thereby aligning them with international standards. However, it would also necessitate training educators on how to effectively utilize the technology, which is an additional challenge.

Objective 3: Improving the Quality and Effectiveness of Russian Education Through Technology. This alternative would improve educational quality by making digital resources widely available, reducing the need for printed textbooks, and lightening students' schoolbags. However, the increased screen time could have negative impacts on students' eyesight.

Analyzing the alternative 2 in relation to the stated objectives, we can assess its compatibility using key considerations:

1. Cost-Effectiveness

Providing 8.7 million Google Nexus 9 tablets at $399 each would require an initial expenditure of approximately $3.48 billion. Given the current economic constraints and the weakness of the Russian ruble against the USD, this is a substantial financial burden. Additionally, with devices needing replacement every two years due to wear and obsolescence, the costs would be recurring, making this alternative financially unsustainable in the long term. While it would immediately address the need for modern educational tools, the high cost might outweigh the benefits, especially considering the frequency of replacements.

2. Device Suitability

The Google Nexus 9 tablet is generally suitable for educational purposes, offering a good balance between portability, screen size, and functionality. However, the limited 16 GB storage might become a constraint as educational materials and apps evolve and require more space. Furthermore, while the device is appropriate for most educational activities, it may not be durable enough to withstand the daily use and potential mishandling by younger students, necessitating frequent repairs or replacements, which adds to the overall cost.

3. Technical Support

The widespread adoption of Google Nexus 9 tablets would necessitate significant investment in technical support infrastructure. Teachers and students would require training to use the devices effectively, which could be challenging given the scale of implementation.

Additionally, ongoing technical support would be crucial to address issues like software updates, hardware malfunctions, and connectivity problems. The state would need to ensure that adequate resources are available for this support, or risk the devices being underutilized or facing frequent technical difficulties.

4. Equity

This alternative has the potential to greatly enhance digital equity by providing all students with access to the same devices and digital resources. This would help to level the playing field, particularly for students from lower socioeconomic backgrounds who might otherwise lack access to such technology. However, the high cost could lead to uneven implementation across regions, with wealthier areas receiving better support and resources, thus perpetuating some aspects of the digital divide. Additionally, the initial financial burden might limit the state's ability to maintain this equity over time.

5. Sustainability

The environmental impact of manufacturing, distributing, and eventually disposing of millions of tablets is significant. While the reduction in printed textbooks is a positive step towards sustainability, the frequent need for device replacements could offset these gains. The production and disposal of electronic devices have associated environmental costs, including energy consumption, e-waste generation, and the use of non-renewable resources. Without a robust recycling program and careful consideration of the devices' lifecycle, this alternative may not be the most sustainable option.

Outcome of Alternative 2

While the provision of Google Nexus 9 tablets to Russian pupils could significantly bridge the digital divide and improve the quality of education by making digital resources universally accessible, it poses serious challenges in terms of cost-effectiveness, sustainability, and the need for substantial technical support. The high initial and recurring costs, coupled with the environmental impact and the necessity of robust training and support systems, make this alternative difficult to implement on a large scale. For this option to be viable, the state would need to explore ways to mitigate these challenges, possibly through phased implementation, public-private partnerships, or investing in more durable and cost- effective devices.

Alternative 3: ASUS Transformer Prime TF201-B1-GR Eee Pad 10.1-Inch 32GB

Objective 1: Avoiding Digital Divide Among Russian School Pupils

This device would similarly provide access to internet materials and education for all pupils. At $451 per tablet with a keyboard, the total cost for 8.7 million devices would be approximately $3.94 billion, which is also financially prohibitive. The recurring costs every two years would further strain the budget, particularly given the ruble's weakness.

Objective 2: Bridging the Digital Divide Between Russia and Other Countries

Equipping students with these devices would bridge the digital gap with other countries, but would still require substantial investment in educator training and support infrastructure.

Objective 3: Improving the Quality and Effectiveness of Russian Education Through Technology. This alternative would enhance educational quality and reduce reliance on paper textbooks. However, the potential harm to students' eyesight from increased screen use remains a concern.

Analyzing the alternative 3 in relation to the stated objectives, we can assess its compatibility using key considerations:

1. Cost-Effectiveness

The ASUS Transformer Prime tablets, priced at $451 each, would require an initial investment of approximately $3.94 billion for 8.7 million devices. This cost is higher than that of the Google Nexus 9 tablets, making it even more financially prohibitive given the economic context, particularly with the Russian ruble's weakness against the USD. The need to replace these devices every two years adds to the financial strain, making this alternative difficult to sustain in the long term. The high upfront and recurring costs could potentially divert funds from other critical areas of education, leading to a misallocation of resources.

2. Device Suitability

The ASUS Transformer Prime offers some advantages in terms of educational suitability. With a 10.1-inch screen and a detachable keyboard, it provides a more versatile and laptop- like experience, which could be beneficial for students engaging in more complex tasks such as typing or programming. However, at 32GB, the storage capacity might still be limiting as educational content and applications grow in size. Additionally, while the device's durability may be better than the Google Nexus 9 due to its keyboard, it still requires careful handling, and the higher cost may not justify the marginal improvements in functionality.

3. Technical Support

Implementing this alternative would require significant technical support, both in terms of training educators and maintaining the devices. The ASUS Transformer Prime, with its more complex features (e.g., keyboard, larger screen), may require more intensive training and support compared to simpler tablets. Ensuring that both students and teachers can fully utilize the device's capabilities would be critical to achieving the educational objectives. The added complexity could also increase the likelihood of technical issues, necessitating a well- established support system, which would require additional resources.

4. Equity

This alternative has the potential to enhance digital equity by providing all students with the same high-quality device, which could help level the playing field. However, the high cost of the devices could lead to disparities in their distribution, particularly in less wealthy regions. If budget constraints limit the number of devices purchased or delay their deployment, some students might not receive the same level of access as others, exacerbating existing inequalities. Additionally, if the state is unable to maintain the program due to financial pressures, the equity gains could be short-lived.

5. Sustainability

The environmental impact of providing ASUS Transformer Prime tablets is significant, similar to the concerns with other digital devices. The production, distribution, and disposal of these tablets, particularly given their higher cost and more frequent replacement cycle, contribute to e-waste and resource consumption. While the use of digital devices could reduce reliance on paper textbooks, the overall sustainability of this approach depends on the establishment of effective recycling programs and efforts to extend the devices' lifespan.

Without these measures, the environmental costs could outweigh the benefits of reduced paper use.

Outcome of Alternative 3

Providing ASUS Transformer Prime tablets to Russian pupils would enhance access to digital resources and align Russian education more closely with global standards. However, the higher cost compared to other alternatives, combined with the need for frequent replacements and the complex technical support required, makes this option less financially and logistically feasible. The potential benefits in educational quality and equity must be weighed against the significant economic and environmental challenges. For this alternative to be viable, careful consideration of cost-saving measures, such as bulk purchasing, phased implementation, or exploring more durable devices, would be essential. Additionally, investments in technical support and sustainable practices would be necessary to maximize the benefits and minimize the drawbacks of this approach.

Alternative 4: Kindle, 6" Glare-Free Touchscreen Display, Wi-Fi

Objective 1: Avoiding Digital Divide Among Russian School Pupils

The Kindle, priced at $50 per device, offers a more affordable solution. The total cost for 8.7 million devices would be approximately $436.35 million, a more manageable sum.

Additionally, parents could be asked to share this moderate financial burden.

Objective 2: Bridging the Digital Divide Between Russia and Other Countries While the Kindle would help mitigate the digital divide, it would need to be supplemented by the already installed PCs in schools to be fully effective.

Objective 3: Improving the Quality and Effectiveness of Russian Education Through Technology. This alternative could significantly improve educational quality by providing easy access to digital textbooks and resources. The Kindle's e-ink display is also less likely to harm students' eyesight compared to LCD screens. However, this would require schools, city libraries, and government libraries to ensure the availability of downloadable books and reference materials.

Analyzing the Alternative 4 in Relation to the Stated Objectives, We can Assess Its Compatibility Using Key Considerations:

1. Cost-Effectiveness

The Kindle, priced at $50 per device, represents a highly cost-effective solution. The total expenditure for 8.7 million devices would amount to approximately $436.35 million, which is significantly lower than the alternatives discussed previously. This cost is far more manageable within the constraints of the Russian educational budget, especially considering the ongoing economic challenges. Moreover, by asking parents to share this relatively moderate financial burden, the state could further reduce its expenses. The lower price point also means that replacing the devices as needed would not impose a severe financial strain, making this alternative sustainable in the long term.

2. Device Suitability

The Kindle's primary function as an e-reader makes it well-suited for accessing digital textbooks and reading materials. Its 6" glare-free e-ink display is designed to mimic the experience of reading on paper, which is easier on the eyes compared to traditional LCD screens. However, the Kindle is limited in functionality compared to tablets like the Google Nexus or ASUS Transformer Prime. It lacks the versatility needed for tasks beyond reading, such as interactive learning activities, video lessons, or complex assignments that require more advanced software. Therefore, while suitable for basic educational purposes, it may not fully meet the needs of a modern, tech-integrated curriculum.

3. Technical Support

Given the Kindle's simplicity, the technical support required for students and teachers would likely be minimal. The device is user-friendly and specifically designed for reading, which reduces the likelihood of technical issues. However, since the Kindle's functionality is limited to reading, schools would still need to rely on existing PCs and other technology for more interactive and complex educational tasks.

The reduced need for technical training and support is a significant advantage, as it lowers the overall implementation costs and simplifies the integration process.

4. Equity

The affordability of the Kindle helps to promote digital equity by making it feasible to distribute the device widely, even in less affluent regions. The low cost reduces the risk of unequal distribution based on economic disparities, ensuring that more students have access to digital resources. However, since the Kindle is limited to reading and does not support a full range of educational activities, there may still be a gap in the digital learning experience between students who have access to more advanced devices and those who only have a Kindle. This could perpetuate some aspects of the digital divide, particularly in terms of access to interactive learning tools.

5. Sustainability

The Kindle is a relatively sustainable option compared to more advanced tablets. Its e-ink display consumes less power, leading to longer battery life and reduced energy consumption. Additionally, the device's durability is generally good, and its specific focus on reading means it is less likely to be discarded quickly in favor of newer technology. However, the environmental impact still includes the production and eventual disposal of millions of devices. To maximize sustainability, it would be important to establish recycling programs and encourage the reuse of devices. The environmental benefits of reducing printed textbook use also contribute positively to the sustainability of this alternative.

Outcome of Alternative 4

The Kindle presents a highly cost-effective and sustainable alternative for reducing the digital divide and enhancing educational quality in Russia. Its low price makes it accessible and feasible to implement on a large scale, while its e-ink display minimizes potential negative impacts on students' eyesight. However, its limited functionality means that it would need to be supplemented by other technologies,

such as PCs already installed in schools, to provide a comprehensive digital learning experience. Although this alternative promotes equity by making digital resources widely available, it may not fully bridge the gap in terms of interactive and advanced educational tasks. For this option to be viable, the government would need to ensure that additional resources and technologies are available to complement the Kindle's capabilities.

Recommendations and Discussion

Policy Formulation

When comparing the four alternatives presented, alternative 4—providing Kindle devices to Russian pupils—emerges as the most advantageous option for several reasons:

1. Cost-Effectiveness and Sustainability

Alternative 4 stands out primarily due to its cost-effectiveness and sustainability. The Kindle is significantly less expensive than the other options, such as Google Nexus 9 and ASUS Transformer Prime tablets. This lower cost not only allows for wider distribution among students, thereby addressing the digital divide more effectively, but also ensures that the initiative can be maintained over time without placing undue financial strain on the government. Furthermore, the Kindle's e-ink display consumes less power, contributing to its sustainability and reducing the environmental impact compared to more power-intensive devices.

2. Scalability

The affordability of the Kindle makes it feasible to implement this solution on a large scale, ensuring that a broader segment of the student population can benefit from digital resources. Unlike the other alternatives, which are constrained by high initial and recurring costs, the Kindle offers a scalable solution that can reach more students, thereby promoting greater educational equity across Russia.

3. Health Considerations

The Kindle's e-ink display is gentler on the eyes than the backlit screens of tablets like the Nexus 9 or ASUS Transformer Prime. This feature is particularly important when considering the long-term health of students, as prolonged exposure to backlit screens has been associated with eye strain and other visual problems. By minimizing these risks, the Kindle provides a healthier alternative for students, supporting their well-being in addition to their educational needs.

4. Complementary Role in Education

While the Kindle's functionality is limited compared to full-fledged tablets, this limitation can be seen as a strength rather than a weakness. The Kindle excels at delivering reading materials and other text-based resources, which are fundamental to education. Its role can be effectively complemented by existing technologies in schools, such as PCs, to handle more complex and interactive tasks. This targeted approach allows for a more efficient use of resources, focusing on what each device does best, rather than overburdening a single device with all educational functions.

5. Equity in Access

The widespread availability of a low-cost device like the Kindle ensures that digital resources are accessible to a larger portion of the student population. This promotes equity by leveling the playing field for students from diverse socioeconomic backgrounds, which is a critical component of bridging the digital divide. The other alternatives, while potentially offering more advanced features, are less accessible due to their higher costs, limiting their ability to promote educational equity on a broad scale.

The proposed solution of state-subsidized e-readers with e-paper technology represents a promising step towards achieving this objective, but it must be complemented by efforts to improve digital literacy and ensure equitable access to the necessary infrastructure.

This initiative would alleviate the financial strain on students and families while ensuring access to current educational materials. The author of this paper believes that Russia should consider introducing state-subsidized e-readers with e-paper technology for grades 6 to 11 and phasing out printed materials. This approach would not only bridge the digital divide but also alleviate concerns about excessive screen time and accommodate subjects that require extensive reading. By implementing this solution, Russia can ensure that all students, regardless of socioeconomic status, have equal access to the benefits of digital learning while minimizing the potential drawbacks, such as *the digital divide* that will be addressed next.

However, as of March 10, 2022, Amazon has ceased shipping products to Russia and discontinued its Prime streaming service in the country due to the ongoing conflict in Ukraine. Given Amazon's lack of facilities in Russia and its policy of not conducting business with the Russian government, coupled with the company's withdrawal from the Russian market, the Russian government will need to explore alternative options, such as Chinese e- book readers. The table below presents Chinese alternatives to the Kindle reader.

Table 2: Chinese Alternatives to the Kindle *Reader*

Brand	Model	Price Range (USD)	Key Features
iReader (Zhangyue)	iReader Light, Smart X	$97 to $539	High-resolution screens, note-taking capabilities
Xiaomi	MiReader, MiReader Pro	$92 to $200	Affordability, integration with WeChat Library
Hanvon	Gold House 3	$123	Simple, ergonomic design
Tencent	Pocket Reader	$136	Small, smartphone-like e-reader, supports 4G mobile cards
Boyue	T80, Likebook Mars	$184 to $212	SD card support, extendable storage
Obook (Guowen)	Dangdang E-reader 8	$141	Designed as a Chinese alternative to Kindle

Policy Implementation and Refinement

To ensure the successful implementation of this policy, a phased approach is recommended. Pilot programs in select schools and regions will allow for testing and refinement before a nationwide rollout. During this pilot phase, feedback from students, teachers, and administrators will be invaluable in identifying potential challenges and optimizing the program's effectiveness.

Long-Term Vision and Adaptability of the policy

As technology continues to evolve and become more affordable, the cost savings associated with this initiative will increase. Additionally, exploring potential bulk order discounts with Amazon could further reduce expenses. In the long term, Russia could consider developing its own e-reader device with innovative features like dual screens.

Follow Up Analysis should Focus on Several Key Areas:

Expenditure on Education and Technology

Researchers should: analyse Russian government spending on education, including allocations for technology and initiatives to bridge the digital divide; Investigate the financial burden on parents for educational expenses, such as textbooks, uniforms, and school supplies.

Costs and Benefits of E-Textbooks

Researchers should: evaluate the potential cost savings associated with digital textbooks, including printing, distribution, and storage expenses; assess the environmental impact of reducing paper consumption through the adoption of e-books; investigate the potential negative health effects of prolonged screen time on students' vision and overall well-being; analyse the pedagogical benefits of e-books, such as interactivity, multimedia content, and personalized learning experiences.

Additional Strategies

While the Kindle initiative is the primary recommendation, complementary strategies should be explored. These might include:

Digital Libraries: Establishing a centralized online library where all textbooks are accessible for free could supplement the e-reader program. Local libraries could also be equipped with digital resources, further expanding access to educational materials. Partnerships: Collaborating with libraries and educational institutions to create a comprehensive digital ecosystem could maximize the impact of this initiative.

Future Research Directions

This study has successfully achieved its primary objective of guiding the Russian government in selecting the most suitable alternative gadget for e-textbooks. However, this is merely the foundation for further exploration into Russia's broader digital education transformation.

Future research should focus on examining the long-term impacts of e-books, assessing the potential of emerging technologies, and critically evaluating current policies to ensure equitable access to quality education across all demographics.

While the potential environmental benefits of transitioning to digital materials—contributing to responsible consumption and production (SDG 12)—are significant, they should not overshadow the necessity for a comprehensive cost-benefit analysis. The long-term financial implications of maintaining and upgrading digital infrastructure, alongside the potential cybersecurity risks, must be carefully scrutinized to ensure the sustainability and security of this initiative.

Conclusion

This study proposed a government policy towards supplying pupils from grades 6-11 with digital e-readers where they could load electronic versions of the government textbooks. It has been proven that alternative 4 (Kindle e-readers) was the best option because it achieved a balance between cost, sustainability, scalability, health considerations, and the equitable distribution of educational

resources. Although it may require supplementation with other technologies to provide a comprehensive digital learning experience, its advantages far outweigh its limitations, making it the most practical and impactful choice for enhancing education in Russia.

Beyond an obvious benefit of reducing tree cutting, printing storing and transporting millions of textbooks, and repeating the process many times to update the material to reflect the recent scientific breakthroughs, this policy will should eliminate the digital divide. If rich and poor, rural and urban pupils will have access to the same textbooks that will have updated semi-interactive material with ability to go further, digital divide in Russia will be prevented and SDG4 be a closer reality. Russia's potential transition to digital textbooks, exemplified by the Kindle initiative, represents a significant opportunity to modernize its education system.

Still, it should be noted that the *UNESCO 2023 Global Education Monitoring Report* warned us that the successful integration of technology in education requires a nuanced and holistic approach. Therefore, while the allure of interactive, up-to-date content on e-readers and digital libraries aligns with the objective of providing quality education (SDG 4), it is crucial to recognize that technology alone is not a panacea. Russia's diverse socioeconomic landscape and varying levels of technological infrastructure necessitate a thoughtful strategy that prioritizes equitable access for all students. This means not only providing digital tools but also ensuring reliable internet connectivity, particularly in underserved areas, investing in comprehensive teacher training programs is paramount. Educators need to be equipped with the skills and knowledge to effectively utilize digital resources in their classrooms, transforming them from passive recipients of information to active participants in the learning process.

Collaboration among various stakeholders is key to navigating these complexities. By fostering partnerships between government agencies, educational institutions, technology providers, and local communities, Russia can create a comprehensive framework that addresses the unique challenges and opportunities presented by digital education.

Ultimately, the true measure of success lies not in the number of digital devices distributed but in the learning outcomes achieved. Technology should be viewed as

a tool to enhance, not replace, the invaluable human connection between teachers and students. By striking a balance between tradition and innovation, Russia can cultivate a dynamic educational environment that prepares its students for the challenges and opportunities of the 21st century.

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