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Connected Education Innovation Program: analysis in light of the Meaningful Connectivity concept

Programa de Inovação Educação Conectada: análise à luz da Conectividade Significativa

Connected Education Innovation Program: analysis in light of Meaningful Connectivity

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RESUMO

Este ensaio teórico visa analisar o Programa de Inovação Educação Conectada à luz do conceito de conectividade significativa e da tríade currículo, avaliação e pesquisa. A conectividade significativa vai além do acesso básico à internet, exigindo velocidade adequada, dados ilimitados e dispositivos apropriados para garantir o uso produtivo e apoiar objetivos educacionais e cívicos. Foram avaliados critérios como velocidade, dispositivos, dados e frequência de uso, visando verificar se o programa atende às demandas do contexto educacional brasileiro. O programa, iniciativa do Ministério da Educação, busca promover o uso pedagógico de tecnologias digitais, capacitando professores e gestores e melhorando a infraestrutura. Apesar de avanços, desafios persistem: velocidades abaixo do recomendado, ausência de dispositivos individuais e falta de dados ilimitados prejudicam a inclusão digital. Além disso, a tríade currículo, avaliação e pesquisa foi subvalorizada, destacando desafios conceituais e estruturais. Superar essas barreiras exige tratar a inclusão digital como direito básico, integrando práticas pedagógicas críticas e promovendo cidadania digital plena.

Palavras-chave: conectividade significativa. políticas públicas educacionais. cidadania digital. Programa de Inovação Educação Conectada.

ABSTRACT

This theoretical essay analyzed the Connected Education Innovation Program through the lens of the concept of meaningful connectivity and the triad of curriculum, assessment, and research. Meaningful connectivity goes beyond basic internet access, requiring adequate speed, unlimited data, and appropriate devices to ensure productive use and support educational and civic objectives. Criteria such as speed, devices, data, and usage frequency were evaluated to determine whether the program meets the demands of the Brazilian educational context. The program, an initiative of the Ministry of Education, seeks to promote the pedagogical use of digital technologies, train teachers and school managers, and improve infrastructure. Despite advances, challenges persist: speeds below the recommended level, the absence of individual devices, and a lack of unlimited data hinder digital inclusion. Furthermore, the curriculum, assessment, and research triad was undervalued, highlighting conceptual and structural challenges. Overcoming these barriers requires treating digital inclusion as a basic right, integrating critical pedagogical practices, and promoting full digital citizenship.

Keywords: meaningful connectivity, educational public policies, digital citizenship, Innovation Education Connected Program.

ABSTRACT

This theoretical essay analyzes the Connected Education Innovation Program from the perspective of the concept of meaningful connectivity and the triad of curriculum, evaluation and research. Meaningful connectivity goes beyond basic access to the internet, requiring adequate speed, unlimited data and appropriate devices to guarantee productive use and support educational and civic objectives. Criteria such as speed, devices, data and frequency of use were evaluated to verify whether the program responds to the demands of the Brazilian educational context. The program, an initiative of the Ministry of Education, seeks to promote the pedagogical use of digital technologies, train teachers and school managers and improve the infrastructure. Despite advances, challenges persist: speeds below recommended speeds, lack of individual devices and lack of unlimited data make digital inclusion difficult. Furthermore, the triad of curriculum, evaluation and research was undervalued, highlighting conceptual and structural challenges. Overcoming these barriers requires treating digital inclusion as a basic right, integrating critical pedagogical practices and promoting full digital citizenship.

Keywords: meaningful connectivity, educational public policies, digital citizenship, Connected Education Innovation Program.

RÉSUMÉ

This theory explains the Programme d'Innovation pour l'Éducation Connectée à la lumière du concept de connectivité significative et de la triade - curriculum, évaluation et recherche. La connectivité significative va au-delà de l'accès basique à Internet, nécessitant une vitesse adéquate, des données illimitées et des dispositifs appropriés pour guarantee une utilisation productive et soutenir les objectifs éducatifs et civiques. Des critères tels que la vitesse, les dispositifs, les données et la fréquence d'utilisation ont été évalués pour verifier si le program

répond aux exigences du contexte éducatif brésilien. Le program, une initiative du Ministère de l'Éducation, aims at promoting the utilization of digital technologies, at former enseignants and school management, and at improving infrastructure. Malgré des progrès, des défis subsistent : des vitesses inférieures aux recommandations, l'absence de dispositifs individuels et le manque de données illimitées nuisent à l'inclusion numérique. In other words, the triad of curriculum, evaluation and recherche a été sous-évaluée, providing evidence of conceptual deficits and structures. Surmounting these obstacles, you need to consider the inclusion number with a foundational approach, integral to the practical pedagogical critiques and promotion of a pleine number level and entière.

Keywords: significative connectivité, politiques publiques éducatives, cytoyenneté numérique, Program d'Innovation Éducation Connectée.

Introduction

I'm trapped in the net
Like a fish in a net
It's zapzap, it's likes
It's Instagram, it's all cleverly designed
Thoughts are clouds
Movement is a drone
The monk in the convent
Awaits the advent of God on an iPhone.[1]

In 1997, Brazilian composer Gilberto Gil released the album *Quanta*, composed of 25 songs, including *"Pela internet"*,[2] whose lyrics refer to those who wanted to join the web, engage in debates, and connect online. At that time, initiatives to expand internet access were scarce, and focused on specific institutions that sought interconnection with other institutions, such as the Research Foundations of the State of São Paulo, the National Laboratory for Scientific Computing (LNCC), and the Federal University of Rio de Janeiro, which connected to institutions in the United States. Twenty-one years later, the same composer released *"Pela internet 2"*, reflecting the rapid expansion of this technology, and now the desire to join the web gives way to: "I'm trapped in the net/Like a fish in a net/ It's zap zap,[3] it likes".

[1] This English translation of the lyrics was done by the author.
[2] I want to join the web/ Promote debate/ Bring together via the Internet/ A group of Connecticut fans.
[3] "Zapzap" is a colloquial term commonly used in Brazil to refer to WhatsApp, one of the most popular messaging apps in the country

Data from the TIC Households 2023 survey, a document prepared by the Regional Center for Studies on the Development of the Information Society, a department of the Brazilian Information and Coordination Center (NIC.br), which operates under the auspices of the United Nations Educational, Scientific and Cultural Organization (UNESCO), indicates that 84% of Brazilian households, approximately 64 million, have internet access—the highest percentage ever recorded, compared to 80% in 2022. This growth was driven especially among women, whose use increased from 86% to 90%. The proportion of users who accessed the internet in the three months prior to the survey rose to 84%, representing approximately 156 million people, with a notable increase among women and individuals with a family income between three and five minimum wages.

Among the key aspects highlighted in the TIC Domicílios 2023 survey on internet use, electronic government stands out—a concept that emerged with the advancement of Digital Information and Communication Technologies (TDIC), particularly the internet, in the digitalization of public services. Initially disseminated in the late 1990s, electronic government began to integrate methods and technologies from the private sector into public administration (CGI.br, 2024b).

In 2023, 73% of internet users aged 16 and over used digital government services, an increase from 65% in 2022, with notable growth in rural areas. However, these services are still primarily accessed by higher-income groups, particularly those earning more than ten times the minimum wage. Among the most used services are those related to public health and workers' rights, cited by 33% of users. Among young people aged 16 to 24, the most accessed services are public education (42%) and personal documents (41%). The main barrier to the full use of digital government services is the difficulty in completing digital transactions, as mentioned by 22% of those who did not use these services, highlighting the need to improve the efficiency of these systems (CGI.br, 2024b).

The report also addresses the issue of those who still lack internet access, and wish to engage in debates and connect online. Around 12 million households still do not have internet access, mainly due to cost (55%), lack of digital skills

(50%), and lack of interest (49%). In addition, 11% of the population, approximately 20 million Brazilians, have never accessed the internet, with the highest prevalence among the elderly (42%), people from social classes D and E (22%), and those with only elementary education (18%). Sole reliance on mobile phones for internet access is common among lower-income individuals, with 50% of people in social classes D and E using only this device (CGI.br, 2024b).

In 2021, then-Senator Simone Tebet, a signatory of Proposed Constitutional Amendment (PEC) 47/2021, proposed adding section LXXIX to Article 5 of the Federal Constitution, establishing digital inclusion as a fundamental right. The text guarantees everyone the right to digital inclusion and imposes on the government the responsibility of expanding internet access nationwide. The justification emphasizes that, in an increasingly connected society, digital inclusion is essential for the exercise of citizenship and social rights, such as education and health, and that the State must implement policies to ensure this right for all citizens. PEC 47/2021, already approved by the Federal Senate, is currently under review in the Chamber of Deputies.

In addition, the Office of the Comptroller General of the Union (CGU) highlights the connection between digital inclusion and digital citizenship, emphasizing the need for equal and high-quality access to digital resources, which is essential for the full exercise of citizenship. Digital citizenship encompasses the rights, responsibilities, and behaviours necessary for active participation in the digital society. It aims to ensure equal access to ICT, promote digital literacy, and encourage participation in democratic processes and digital governance. Furthermore, it involves the responsible use of ICT, understanding privacy and security issues, distinguishing between true and false information, and contributing to the integrity of the virtual community—ultimately strengthening citizens' active and informed participation in social development (Brasil, 2024a).

This article builds on the understanding that, despite the growing number of internet users in the country and the reduction in the number of people without access, these advances are still not enough to guarantee the full exercise of citizenship in digital times. This finding is supported, among other aspects, by the

research *"Meaningful Connectivity: Proposals for Measurement and a Portrait of the Population in Brazil*", also developed by the Internet Steering Committee in Brazil, which addresses the issue of the digital opportunity gap.

The digital divide is not just about access to the internet but about the opportunities that access provides. It concerns what opportunities for education, employment, and public participation are available to each individual, depending on the quality of their connection. The impact of not having internet access becomes even more severe as more aspects of modern life move to the digital realm. For many young people, being disconnected can mean missing out on future opportunities.

This situation, known as the digital opportunity gap, reflects how a lack of access or meaningful connectivity limits a person's chances of learning, working, living, and connecting compared to those who have full access to the internet (CGI.br, 2024a).

Furthermore, the reflections presented in this paper also align with the request made by the Internet Steering Committee in Brazil regarding public policies.

> **Policymakers need to address gaps in digital skills, security, and human rights to build an enabling social environment for people as they come online for the first time**. This will be a responsibility not only for policymakers in the field of information and communication technologies (ICT) but will also require a collective responsibility extending to all ministries and regulatory bodies, as well as the private sector and civil society. **We urge policymakers to be bolder than ever before in connecting the unconnected and building a supportive social environment for a vibrant and inclusive online world** (CGI.br, 2024a, p. 32).

In this context, this theoretical essay aims to analyze the Connected Education Innovation Program in light of the concept of meaningful connectivity and the triad of curriculum, assessment, and research. The focus is on how this public policy can guarantee not only access to ICT but also the quality of that access, ensuring that it is used critically to promote education for digital citizenship.

The article is divided into two theoretical sections: the first, entitled "Meaningful Connectivity: Contextualization," aims to present the concept of meaningful connectivity and the criteria that underpin this reflection; the second, "Connected Education Innovation Program and Meaningful Connectivity: An

Analysis," seeks to analyze the Connected Education Innovation Program in light of the four criteria that guide meaningful connectivity.

Meaningful Connectivity: Contextualization

The Alliance for Affordable Internet (A4AI), an organization dedicated to reducing the cost of internet access in low- and middle-income countries through policy and regulatory reforms, highlights the importance of meaningful connectivity. This concept goes beyond mere internet access, emphasizing the need for this access to be regular, high-speed, and accompanied by adequate data and devices, enabling productive use and supporting broader socioeconomic goals such as education, employment, and civic participation.

According to the report *"Meaningful Connectivity: A New Goal to Raise the Bar for Internet Access*", prepared by A4AI, four key criteria should be adopted to assess internet access. These focus on speed, device, data availability, and frequency of access, ensuring that users can fully participate in the digital economy and society in an empowering and transformative way. These criteria are:

1. Speed:

The report highlights the importance of connection quality for a meaningful online experience, stating that meaningful connectivity requires a reliable, high-speed, low-latency connection to enable full use of the internet, particularly for data-intensive activities such as video streaming. 3G networks, which remain common in low- and middle-income countries, often provide an inferior experience, with download speeds below 10 Mbps and high latency. For this reason, A4AI advocates for universal access to 4G, which offers the minimum technical requirements necessary for video streaming and other online activities. Moreover, the report underscores that 4G remains inaccessible to many users due to its cost, particularly among low-income populations, emphasizing the need for public policies to make these connections more affordable.

2. Adequate Device:

A4AI asserts that an adequate device is essential to ensure meaningful connectivity, enabling people not only to consume content but also to create it. This is key to fostering full participation in the digital world and reducing digital inequalities. The report highlights that, without appropriate devices, users are restricted to basic activities and cannot fully leverage the potential of the internet, such as accessing government digital services or applying for jobs. Furthermore, many users with low literacy develop their digital skills through smartphones, which become crucial tools for increasing digital inclusion and fostering greater engagement in the digital sphere.

3. Data Availability:

The report discusses the disparity in internet access between those with unlimited data and low-income users who face data scarcity. Data scarcity refers to the limitations and unreliability of internet access, which hinder users from meaningfully engaging with the internet, forcing them to ration their usage or rely on public access points. The expansion of meaningful connectivity depends on regular and reliable access at home, work, or school, suggesting that expanding broadband coverage in public spaces is a viable strategy to enhance connectivity.

4. Frequency of Use:

Daily access to the internet is the bare minimum for meaningful connectivity. Regular use ensures that people can stay informed in real-time, interact in online communities, and access public services, particularly during emergencies and crises when up-to-date information is crucial.

These four criteria—speed, adequate device, data availability, and frequency of use—define meaningful connectivity, underscoring the importance of not just being connected, but being connected in a way that enables full participation in society, particularly in areas such as education, employment, and civic life.

For the Global Digital Inclusion Partnership (GDIP), a coalition of public, private, and civil society organizations working to expand internet connectivity to the majority of the global population and ensure that everyone is meaningfully

connected by 2030, there is a notable gap between the recommendations outlined by A4AI and those of the International Telecommunication Union (ITU).

The ITU, the UN agency specializing in ICT, takes a perspective that, compared to the requirements for meaningful connectivity outlined by A4AI, fails to fully meet current demands for internet access.

Table 1 – Comparison of ITU and A4AI

	ITU definition	A4AI definition
Speed	No minimum speed	4G Speed
Appropriate Device	Any device	Personal mobile phone
Data Availability	No minimum	Unlimited broadband access
Frequency of Use	At least once in the last three months	Daily use

Source: GDIP (2021)

Despite the differences between the ITU and A4AI, both recommend that governments participate in the process of developing initiatives to enhance meaningful connectivity and promote internet usage. A4AI advises that governments adopt the four mentioned criteria—speed, appropriate device, data availability, and frequency of use—to reduce the digital divide and ensure that everyone can benefit from the opportunities offered by the digital world. To this end, it suggests the following steps:

1. Foster consensus among the public and private sectors, as well as civil society, to discuss the adoption and applicability of the criteria.

2. Review national policies and regulatory frameworks to assess the current state of connectivity policies and targets, particularly those related to meaningful connectivity.

3. Develop initiatives within statistical institutions to measure these criteria and incorporate suggested indicators into data collection processes.

In Brazil, discussions on meaningful connectivity have been taking place within the scope of CGI.br, particularly through the Brazilian Information and Coordination Center (NIC.br). Based on the reflections proposed by ITU and A4AI, among others, NIC.br prepared the document *"Meaningful Connectivity: Proposals for Measurement and a Portrait of the Population in Brazil."* This study defines four main categories to measure meaningful connectivity: Affordability, Access to Equipment (Devices), Connection Quality, and Usage Context. Each of these dimensions includes specific indicators classified as household or individual, depending on the type of data analyzed.

Affordability considers whether household internet expenditure is below 2% of the family income, which is classified as a household indicator, while the evaluation of mobile phone plans, verifying whether an individual has a postpaid plan, is categorized as an individual indicator.

The dimension of access to equipment (devices) assesses whether there is more than one access device (such as a mobile phone, desktop, notebook, or tablet) per household resident aged 10 or older and whether there is a computer in the household. It also examines whether individuals use both a mobile phone and a computer, which reflects a more diverse use of digital devices.

Connection quality is measured by two factors: the type of home connection, which verifies whether the household has fiber optic or cable internet, and the household connection speed, which assesses whether the main internet connection reaches a speed of at least 10 megabits per second (Mbps).

Lastly, the usage context dimension examines how frequently individuals use the internet, specifically whether they access it daily or almost daily, and whether they use the internet both at home and in at least one other institutional setting, such as schools, workplaces, or free and paid internet access centers.

To analyze the Brazilian context, the nine indicators were dichotomized to reflect the presence (1) or absence (0) of a given connectivity characteristic for each individual in the sample. For example, the indicator “diverse use of devices” assigns

1 to individuals who use both a mobile phone and a computer and 0 to those who either lack this combination or were unable to provide information.

Figure 1 – Significant Connectivity Levels

Source: Information and Coordination Center of Ponto BR (NIC.br).

Accordingly, a scale ranging from 0 to 9 was developed, where each individual's score reflects how many of the nine measured characteristics they possess. A score of 0 indicates the absence of all measured characteristics, while a score of 9 signifies that the person meets all the established criteria. For example, as outlined in the report, an individual with a score of 9 lives in a household equipped with a computer and a high-speed internet connection (>10 Mbps), at a cost of less than 2% of household income. Additionally, this person owns multiple internet access devices and uses both a mobile phone and a computer, accessing the internet daily at home and in other locations.

Based on these scores, four levels of meaningful connectivity were established. The first level, with scores ranging from 0 to 2, indicates the most precarious connectivity conditions. The second level, with scores of 3 and 4, includes

individuals who remain vulnerable in terms of access. The third level, with scores between 5 and 6, represents intermediate connectivity conditions. Finally, the fourth level, with scores from 7 to 9, corresponds to the most favorable conditions for meaningful connectivity.

Notably, digital skills pertain to an individual's ability to perform various online activities, such as copying and pasting, attaching files, installing applications, implementing security measures, and verifying the accuracy of information. The data reveal a direct correlation between the level of meaningful connectivity and proficiency in these skills. For instance, 78% of users with high connectivity (scores between 7 and 9) use the copy and paste function, compared to only 19% of those with low connectivity (scores between 0 and 2). The same trend applies to other digital skills, such as attaching files, installing software, and adopting security measures.

Furthermore, skills related to online security and privacy, including the ability to verify the accuracy of information, are also strongly associated with the level of meaningful connectivity. Only 19% of users with low connectivity verify the accuracy of the information they access, whereas this practice is adopted by 76% of those with high connectivity.

In this context, education plays a central role not only in developing digital skills but also in promoting meaningful connectivity and enabling the full exercise of citizenship in the digital environment. Digital citizenship emerges as a fundamental component of democratic citizenship, as outlined in Brazilian legal frameworks (Brasil, 2024a; Brasil, 2021). It encompasses not only access to technological infrastructure but also the right to engage critically and safely with ICTs. The formation of citizens who can navigate and utilize the digital environment in an informed and secure manner depends directly on public policies aimed at digital inclusion and the reinforcement of pedagogical strategies for integrating digital technologies into education. Thus, public policies focused on meaningful connectivity must incorporate educational initiatives that foster digital citizenship, strengthening social inclusion and civic participation for all Brazilians.

Innovation Program for Connected Education and Meaningful Connectivity: An Analysis

The Innovation Program for Connected Education is an initiative of the Ministry of Education (MEC), regulated by Decree 9,204 of 2017. It aims to promote the pedagogical use of digital technologies in Brazilian public schools, fostering connectivity and digital literacy for teachers and school administrators. The program is structured around four main dimensions: Vision, Professional Development, Digital Educational Resources, and Infrastructure.

The Vision dimension guides the integration of innovation and technology within the education system, focusing on quality, equity, and public school management. The Professional Development dimension includes continuous training for teachers and administrators, as well as support materials that incorporate technology into pedagogical practices. In Digital Educational Resources, the program includes the provision of digital tools and the promotion of the creation, acquisition, and sharing of these resources among education networks. The Infrastructure dimension invests in expanding connectivity access and improving schools' internal and technological infrastructure, enabling the effective use of digital technologies in classrooms.

The analysis of the Innovation Program for Connected Education through the lens of meaningful connectivity will be based on the four criteria established by A4AI: speed, appropriate devices, data availability, and frequency of use.

Regarding high-speed internet access, the program sets internet speed targets based on the number of students, teachers, and staff connected simultaneously. According to program guidelines, schools should contract speeds ranging from 20 Mbps to 100 Mbps, depending on the number of users. For example, for a school with up to 200 students, a minimum speed of 20 Mbps is recommended, while for schools with 501 to 1,000 students, the recommendation is 100 Mbps. These metrics are intended for basic internet use, considering 100 Kbps per student, as illustrated in the report. However, A4AI's recommendation for meaningful connectivity is at least 10 Mbps per user, suggesting that the speeds established by the program may not be sufficient for broader and more productive internet use.

Regarding access to appropriate devices, the Innovation Program for Connected Education primarily focuses on providing equipment for internet distribution in schools, such as Access Points (APs), switches, firewalls, and security software. The program also includes the installation of network infrastructure, such as cabling and connectivity services. However, it does not address the provision of individual devices for students or teachers. The lack of personal devices limits users' ability to fully explore the potential of the internet, restricting access to learning and development opportunities (A4AI, 2020). The reliance on shared devices in schools may limit student autonomy and full digital participation, restricting their learning experiences and opportunities for digital engagement. This highlights a key challenge in advancing meaningful connectivity—the need for personal devices that enable greater digital interaction and help bridge digital inequalities.

The third criterion, data availability, also requires greater clarification within the Innovation Program for Connected Education. A4AI highlights that data scarcity can compromise meaningful connectivity, as it limits continuous access and full engagement in the digital environment. While the program does include plans to expand connectivity in schools, with a focus on infrastructure and internet services, it does not specify whether the connection offered to schools, students, and teachers will be unlimited. This gap could restrict internet usage, limiting students' ability to fully benefit from digital educational opportunities.

The fourth criterion, related to daily internet access, addresses the regularity with which students and teachers can connect to the internet. The Innovation Program for Connected Education prioritizes school-based connectivity, without addressing internet access beyond the school setting. This raises concerns about continuity in digital learning, as students may not have the same level of connectivity at home.

As emphasized by A4AI, daily internet access is considered the minimum requirement for meaningful connectivity. Continuous internet use enables students and teachers to stay updated in real time, engage in online communities, and access essential digital services—especially in emergencies or crises, when access to up-to-date information is critical.

The studies by Almeida and Valente (2020; 2022) explore Brazilian initiatives focused on integrating ICT into education, particularly those related to public policies, as well as discussions on elements beyond infrastructure, content and resources, skills, and perspectives on educational technologies. According to the authors, the triad of curriculum, evaluation, and research is often overlooked or even ignored in Technology Policies in Education in Brazil, despite being essential for building an education system integrated with digital culture.

The curriculum should be seen as a dynamic rather than a fixed element. It is linked to what is socially deemed valid and is selected during the development of curricular policies, later revised and reinterpreted in school pedagogical projects and teachers' classroom practices. This curriculum incorporates content, methods, and activities, integrating scientific and cultural knowledge, teachers' practical expertise, and students' prior knowledge. When aligned with digital culture, the curriculum requires new teaching and evaluation strategies that incorporate ICT, curriculum, and research in an integrated manner (Almeida; Valente, 2020).

In the Connected Education Innovation Program, the curriculum dimension is briefly outlined in the Program Guidelines. The Support Actions in the Training Dimension highlight that the Ministry of Education is responsible for providing reference curricula for technology-mediated teacher training, aligned with the Common National Curriculum Base (BNCC). However, there is no mention of potential (re)formulation of existing curricula in educational contexts. This suggests a limited curricular scope or a perception of the curriculum as something that unfolds in practice as originally envisioned, disregarding the educational relationships that influence curriculum development.

For Almeida and Valente (2020), evaluation is intrinsically linked to the curriculum, encompassing not only student learning assessment but also the evaluation of teachers, courses, institutions, and educational systems. In public policy, evaluation is part of the policy cycle and information demands, aimed at supporting decision-making regarding the implementation and impact of public policies and programs.

In the Connected Education Innovation Program, evaluation is also addressed in the Guidelines, particularly within the Support Actions. These guidelines propose a plan for technology adoption in education, including monitoring strategies for continuous evaluation and improvement, and establish the National Network of Evaluators of Digital Educational Technologies, responsible for selecting and evaluating such technologies. However, there is no evidence of how data generated through monitoring is used to improve engagement with educational stakeholders (managers, teachers, and the school community). Instead, the burden falls on them to provide information to feed the system, indicating a focus on external monitoring and evaluation.

Additionally, specific responsibilities are assigned to different stakeholders. Basic education networks that join the program must report on its implementation, following Ministry of Education guidelines for monitoring and evaluation. Meanwhile, the National Bank for Economic and Social Development (BNDES) is responsible for structuring and coordinating program monitoring and evaluation, with a focus on financial resource allocation.

However, the program does not include an evaluation framework encompassing student learning, teacher performance, or institutional and systemic assessments. It limits its scope to evaluating technology usage and compliance reporting by education networks and the BNDES. Consequently, there is no integrated evaluation approach that considers all levels and actors within the education system, as proposed by Almeida and Valente (2020). Implementing such an approach could strengthen monitoring strategies and support continuous policy improvement.

Building on the concepts of curriculum and evaluation discussed, the research dimension in educational technology policies should move beyond the university-school divide, fostering collaborative spaces for interaction, reflection, and joint knowledge production between academic researchers and practicing teachers. In this approach, research is conducted within schools and with school participants, rather than being carried out "on" schools or "on" teachers, promoting

collaborative research embedded in the educational context (Almeida; Valente, 2020).

In the Connected Education Innovation Program, the research dimension is addressed in the Guidelines, particularly in the section on Continuing Education for Local Articulators. According to these guidelines, a Local Articulator, typically a public school teacher, may receive a scholarship for research and training as part of the continuing education course, as outlined in Law 11.273/2006.

However, there is no mention of university integration in the research process or of academic contributions to teacher training curricula that align with school realities and meaningful connectivity. The lack of guidelines encouraging university researchers' participation hinders collaboration between academia and schools, preventing the development of joint research spaces and reflective practices that could enhance research and strengthen program implementation.

The Connected Education Innovation Program represents a significant step toward integrating digital technologies into Brazilian public schools, providing initial guidelines for digital inclusion. However, it faces challenges when analyzed through the lens of meaningful connectivity, as proposed by A4AI, and when considering the triad of curriculum, evaluation, and research. The lack of individual devices, absence of guaranteed unlimited data, insufficient speed targets, restricted focus on school-based connectivity, and internet usage prioritized for administrative and management purposes (Cerny; Almeida; Espindola, 2023) limit the program's potential to foster full and equitable digital inclusion for digital citizenship development.

To achieve meaningful connectivity, greater alignment with A4AI's four criteria and deeper engagement with curriculum, evaluation, and research perspectives are essential to ensure that students and teachers have the necessary conditions to continuously and effectively leverage digital opportunities.

Final Considerations

This theoretical essay analyzed the Connected Education Innovation Program in light of the concept of meaningful connectivity and the triad of

curriculum, evaluation, and research, revealing important advances but also critical gaps that hinder full digital inclusion in the Brazilian educational context.

The connection speed targets set by the program, although a positive step, do not fully meet A4AI's recommendations, which recommend a minimum of 10 Mbps per user. This limitation hinders the pedagogical potential of ICT in schools, particularly in activities that require high bandwidth, such as live streaming and the use of multimedia resources. Additionally, the lack of individual devices for students and teachers restricts full and continuous access to digital tools, hindering the development of essential skills for digital citizenship.

Another critical issue is the lack of clarity regarding the provision of unlimited data within the program, a key factor in ensuring continuous internet access both inside and outside the school environment. Without guaranteed unlimited data, connectivity remains intermittent and insufficient to meet the educational and civic needs of users. Moreover, the program's restricted focus on in-school connectivity overlooks the necessity of daily and continuous internet access, which is essential for students and teachers to fully leverage digital opportunities in their everyday activities.

Connectivity within the program is limited, often serving administrative functions, such as school management tasks and system reporting by teachers. As a result, the program does not foster an environment conducive to the full integration of ICT into the curriculum, limiting the potential to maximize digital tools in pedagogical practices. This absence of basic guarantees for meaningful connectivity in the policy compromises the preparation of citizens for the full exercise of digital citizenship. The lack of an adequate digital environment not only limits access to technology but also inhibits the development of pedagogical practices that encourage critical thinking, collaboration, and active student engagement in digital learning.

These limitations highlight structural and conceptual challenges within the triad of curriculum, evaluation, and research, which, as Almeida and Valente (2020) emphasize, is often undervalued in educational technology policies in Brazil. The lack of individual devices and rigid curricular models limit ICT integration into the

educational process. Likewise, the absence of evaluation strategies that incorporate data generated by program users restricts the potential to improve and refine the actions implemented. Finally, research, a fundamental component of educational advancement, lacks stronger collaboration between universities and schools, preventing the creation of joint research spaces for reflection and innovation.

In this scenario, education plays a central role, not only in developing digital skills but also in promoting meaningful connectivity and ensuring the full exercise of digital citizenship. Digital citizenship is an essential component of democratic citizenship, as outlined in Brazilian legal frameworks (Brasil, 2024a; Brasil, 2021). It encompasses not only access to technological infrastructure but also the right to meaningfully engage with ICTs in a critical and safe manner. The development of citizens who can navigate and use the digital environment responsibly depends directly on public policies that promote digital inclusion and strengthen pedagogical practices in the use of digital technologies.

Even if full school connectivity is achieved, it remains essential to question the role of connectivity in the broader objectives of basic education, as reflected in curricular policies, school pedagogical projects, and teacher work plans. It is crucial to reflect on how connectivity contributes to developing logical reasoning, critical thinking, problem-solving, and collaboration skills—including engaging with experts and peers from diverse backgrounds. Additionally, it is fundamental to explore how connectivity can foster active participation in social transformation, empowering individuals through critical engagement and the (re)construction of knowledge.

When integrated into well-structured public education policies, meaningful connectivity has the potential to reshape schools, fostering creativity, critical thinking, autonomy, humanization, and the holistic development of ethical citizens. This perspective underscores the importance of stronger alignment between curricular guidelines, pedagogical practices, and ICT usage, ensuring that connectivity serves as a means to achieve transformative education.

Therefore, for Brazil to reach high levels of meaningful connectivity, digital inclusion and digital citizenship must be recognized as fundamental rights, fully

integrated into public education policies. Meaningful connectivity is not just about ensuring technological access; it is also about promoting the responsible, critical, and secure use of ICTs, which is essential for fostering active and engaged citizens in the digital age.

In an increasingly connected world, the success of policies such as the Connected Education Innovation Program will depend on addressing existing gaps and advancing efforts to create inclusive educational environments that support social inclusion and digital citizenship. Through coordinated efforts among government, the private sector, and civil society, it is possible to transform the program into a benchmark for digital inclusion in Brazil, ensuring that no student is left behind in building a more connected, equitable, and democratic future.

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