South American Development Society Journal
Vol.: 11| Nº.: 31| **Ano:** 2024 | **ISSN:** 2446-5763 | **DOI:** 10.24325/issn.2446-5763.v11i31p42-64
Data de Submissão: 02/02/2025 | **Data de Publicação:** 18/04/2025

"THE FIRST SOCIAL SCREEN": A SUPERVISED DIGITAL ENVIRONMENT FOR SOCIAL MEDIA ATTUNEMENT

Luiz Guilherme Antunes
Universidade de São Paulo – Escola de Comunicações e Artes (ECA/USP)
radfahrer@usp.br

Francisco Tupy Gomes Corrêa
Universidade de São Paulo – Escola de Comunicações e Artes (ECA/USP)
tupy@usp.br

Sushila Vieira Claro
Universidade de São Paulo – Escola de Comunicações e Artes (ECA/USP)
sushila.claro@usp.br

Abstract

Smartphone adoption among youth has dramatically shifted, with average first ownership now occurring at age eight and daily usage soaring to 7.5 hours—a 40% increase in just five years.

This digital immersion is fundamentally altering communication patterns, educational approaches, and social development, creating a reality where many young people spend more time with screens than engaging in face-to-face interactions or traditional learning or socio-cultural activities.

This study proposes a structured approach to adolescent4 digital literacy education through a supervised smartphone environment designed for school implementation. Unlike traditional monitoring systems, our platform employs an Artificial Intelligence (AI) mediated supervision to balance privacy with appropriate oversight. By creating a closed ecosystem mirroring popular social media platforms, this platform aspires to provide adolescents with practical experience to develop critical digital competencies while addressing gaps in current adolescent digital education by providing hands-on experience in a supervised environment that balances privacy with safety, bringing the social protagonism back to educational institutions for predict (for example: c ollective and individual patterns that allow management to anticipate both performance and socio-emotional issues, intervening beforehand to prevent

problems or enhance positive outcomes, while also being scalable). We propose a theoretical framework, system architecture, and implementation considerations for such platform.

Keywords: digital literacy, empathy, social media, artificial intelligence, privacy, digital citizenship

"The First Social Screen": A Supervised Digital Environment for Social Media Attunement

The widespread adoption of smartphones among young adolescents has created unprecedented challenges for educators, parents, and society at large worldwide, in many different cultures and social environments. Recent researches indicate that 95% of teenagers have access to smartphones[1], with the average age of Mobile phone adoption in the United States starting in late childhood and early adolescence between 8-11 years old (Pew Research Center, 2024).

While digital technologies offer opportunities for learning and social connection (for example: Learning in an interconnected way, creating Digital Artifacts, promoting Autonomy in the Learning Process, applying Algorithms as Mediators of Knowledge, dealing with Post-truth and Disinformation), they also present significant risks, including exposure to inappropriate content, cyberbullying, and privacy breaches, as shown by George and Odgers (2015).

We propose an innovative AI-augmented smartphone ecosystem engineered expressly for educational institutional deployment. This framework diverges significantly from conventional surveillance mechanisms, which typically provide unrestricted access to parental figures and educational personnel, or alternatively, depend exclusively on algorithmic content filtration. Our platform incorporates a sophisticated Artificial Intelligence (AI) architecture that identifies potentially problematic material generated or disseminated by users. Upon detection, the

[1] According to the Statista research "*Percentage of teenagers in the United States who have access to a smartphone at home as of October 2023, by gender"*, September 26 to October 23, 2023, age group 13 to 17 years, among a sample of 1,453. Retrieved from https://www.statista.com/statistics/256501/teen-cell-phone-and-smartphone-ownership-in-the-us-by-gender/ March 9, 2025

system's conversational agent interfaces directly with users to elucidate possible consequences of their digital actions, recommend temporal deferment of content publication ranging from minutes to hours, or, in cases of persistent behavioral patterns, escalate concerns to designated institutional supervisors for comprehensive evaluation. The system maintains strict informational boundaries, categorically prohibiting access to users' confidential data by individuals with preexisting relational dynamics—including but not limited to familial connections, current or former instructional staff, peer cohorts, or any parties with established interpersonal affiliations. This methodological approach preserves essential user confidentiality while simultaneously facilitating appropriate supervisory oversight within educational environments.

As a counterpoint, we evoke the article by Glahn and Mazza (2018) as an example of the integration of native mobile applications into institutional educational ecosystems, addressing technical issues such as authentication, authorization, and identity management to ensure interoperability between devices and academic infrastructures. In contrast, the proposed study on a supervised environment for adolescents uses artificial intelligence (AI) as a mediator to balance privacy with supervision, creating a closed ecosystem that simulates social media with the aim of teaching digital literacy and developing critical competencies. While the first deals with infrastructure and security challenges in university contexts, the second focuses on practical and experiential education for adolescents, with an emphasis on predicting behavioral and socio-emotional patterns through AI. Thus, Glahn and Mazza (2018) is aimed at the technical integration of apps into complex educational systems, while the supervised study explores a controlled environment for critical digital education and citizenship.

Our prototype aims to address the growing body of research across the world, highlighting the relationship between early social media use and adolescent well-being. Studies have shown that unguided initial experiences with digital platforms can establish problematic usage patterns that persist into adulthood (Bada et al., 2024). By providing a structured first exposure to digital social environments, this system aims to foster healthy digital habits and critical thinking skills.

This prototype establishes a self-contained digital ecosystem that emulates contemporary social media platforms and applications, designed to afford adolescents a scaffolded environment for cultivating essential digital literacies while maintaining appropriate protective measures. This approach facilitates a transition from abstract pedagogical instruction to experiential, monitored learning. The framework extends Antunes' (2015) educational paradigms and methodological frameworks, which transcend mere content dissemination toward comprehensive social development within educational settings. The system prioritizes the cultivation of interpersonal competencies, implementation of dynamic pedagogical approaches, cross-disciplinary initiatives, formative evaluation protocols, and enhanced agency for contemporary educators. This design philosophy endeavors to reestablish educational institutions as central facilitators of digital engagement, with particular emphasis on the acquisition of constructive social interaction competencies within digital contexts.

2. Literature Review

2.1 Adolescent Smartphone Usage Patterns

Research on adolescent smartphone usage patterns reveals increasingly early adoption of digital technologies.

Recent longitudinal studies indicate that the average age of first smartphone acquisition has **“The First Social Screen”:** A Supervised Digital Environment for Social Media Attunement 5 decreased. Currently in the United States, 53% of children have a smartphone by age 11, and 19% of 8-year-olds having their own smartphone, an increase from 11% from 2015 to 2019[2].

The implications of early smartphone access have been extensively studied, with research revealing complex relationships between usage patterns and developmental outcomes, affecting language proficiency, mental health, sleep quality, and overall well-being. Research indicates that the concern seems to be global: early access may not universally harm language skills, but it can negatively

[2] Rideout V, Robb M. *Common Sense Media*. San Francisco, CA: Common Sense Media; 2019. Oct 28, [2022-03-10]. The common sense census: media use by tweens and teens. Survey of more than 1,600 U.S. 8- to 18-year-olds.

impact heavy media users, as noticed in Italy by Gerosa & Gui (2023). Additionally, excessive smartphone use is linked to increased nomophobia, anxiety, and depression among adolescents in India (Moradiya, 2025). Furthermore, smartphone usage disrupts sleep patterns, which are crucial for learning and memory retention (Macharla et al., 2025).

2.2 Persistent Connection, Digital Privacy and Supervision Models

Ribeiro et. al. (2019) exploratory qualitative study on the constant use of smartphones among Brazilian university students has shown that there is intense ambivalence in the evaluations that young people make of the experiences of constant connection, signaling adjustments in the regulation of privacy and in the interactional dynamics based on the singular uses and appropriations of smartphones.

In Indonesia, Maryani et. al. (2020) addressed teenager’s awareness of online privacy, the psychological and cultural aspects of vulnerable online privacy practice by teenagers, revealing that teenagers’ knowledge, awareness, and management of online privacy was relatively low. Psychologically, teenagers often need others to talk to. To maintain relationship, some cultural aspects, such as togetherness, friendliness, and openness to strangers were perceived as important. However, those aspects were the causes of poor online privacy practices.

The effectiveness of AI-mediated supervision has also emerged as a crucial area of research. Milosevic et. al (2023) designed a set of AI-based interventions into cyberbullying that build on proactive content take-down, based on social learning and social norm theories; they solicited children's views via focus groups and in-depth interviews as to their perceived effectiveness and impact of such interventions on children's rights (children from Ireland, age 12–17, N = 59). In this study, most of the children held mixed views about whether they would welcome some form of proactive AI-based scanning, monitoring, or “AI working in the background” for the purpose of detecting cyberbullying which they saw as “the greater good,” that is, the benefits outweighed the costs. Nonetheless, when probed further about privacy concerns, they were unsure whether they would actually use it.

2.3 Digital Literacy Education

Traditional approaches to digital literacy education have shown limited effectiveness in preparing adolescents for real-world digital challenges, according to Santander-Salmon and Rodriguez-Ayala (2024), highlighting the importance of critical thinking and active citizenship, while identifying challenges like the digital divide and opportunities for inclusive educational strategies. Their research highlighted the gap between classroom instruction and practical application, noting that students often struggled to transfer learned concepts to real-world digital situations.

The IEA International Computer and Information Literacy Study (ICILS) (Fraillon et al., 2014) researched the extent to which young people have developed computer and information literacy, which is defined as the ability to “use computers to investigate, create and communicate with others at home, school, the workplace and in society”. Data were gathered from almost 60,000 Grade 8 students in more than 3,300 schools from 21 education systems. This information was augmented by data from almost 35,000 teachers in those schools and by contextual data collected from school ICT-coordinators, school principals and the ICILS national research centers. The IEA ICILS team systematically investigated differences among the participating countries in students CIL outcomes, how participating countries were providing CIL-related education and how confident teachers were in using ICT in their pedagogical practice. The team also explored differences within and across countries with respect to relationships between CIL education outcomes and student characteristics and school contexts. In general, the study “The First Social Screen”: A Supervised Digital Environment for Social Media Attunement findings presented in this international report challenge the notion of young people as digital natives with a self-developed capacity to use digital technology.

2.4 School-Based Technology Interventions

Vallès-Peris and Domènech (2024) show that strategies for fostering digital citizenship at school should transcend the mere use of digital devices or instructional

methods focused solely on their use. Their core premise rests on the need for an ethical-political debate concerning digitization in education. In addition, their research suggests that digital literacy serves as a foundation for meaningful participation in digital societies; and it also underscores the importance of democratizing digital technologies by incorporating the perspectives, needs, and concerns of children.

Drawing inspiration from the theories of pragmatism and responsible research and innovation (RRI), the authors present a conceptual framework for digital citizenship which adapts John Dewey's pragmatic model of inquiry as a method that can be applied within the school setting. Their practical implementation of its methodology is illustrated through an actualized experience with 10- and 11-year-old children in a public primary school, regarding the issue of care robots. Also, we can consider, as an example, Intentional Pedagogical Mediation (Teachers acting as facilitators in debates on digital privacy; Antunes, 2012a; Ribble, 2015), Development of Digital Social Skills and Implementation of supervised collaborative activities (Antunes, 2012a; Bandura, 1977; Vygotsky, 1978), Interdisciplinary Approach and Connection between different areas of knowledge in the digital context (Antunes, 2012a; Fraillon et al., 2014; Vallès-Peris & Domènech, 2024) ans Progressive Formative Assessment and Continuous Adaptive Feedback System (Antunes, 2012a; Bruner, 1960; Lave & Wenger, 1991).

2.5 Research Gaps

While existing literature provides substantial insight into various aspects of digital literacy education and smartphone use among adolescents, several critical gaps remain. Longitudinal studies examining the long-term impacts of structured digital environment exposure are limited, with most current research focusing on short-term outcomes. Research on the effectiveness of AI-mediated supervision in educational settings, while promising, requires further validation across diverse populations and contexts.

Furthermore, there is a notable lack of large-scale studies examining the implementation of comprehensive digital literacy programs that combine restricted environments, AI supervision, and progressive skill development. This gap is

particularly significant given the increasing evidence suggesting the importance of integrated approaches to digital literacy education.

3. Theoretical Framework

This prototype design is grounded in the theoretical intersection of educational psychology, digital literacy development, and adolescent social development.

Bandura's (1977) social learning theory posits that individuals learn through observation, imitation, and modeling within social contexts. In the digital realm, this theoretical framework takes on new significance in social media environments where behavioral modeling occurs both explicitly and implicitly. Our proposed system leverages this theory by an environment where positive digital behaviors can be modeled, practiced, and reinforced.

Our prototype means to extend physical social learning theory into the digital social space through a structured approach where students progressively engage with more complex digital social situations as their competency develops. This approach aligns with Vygotsky's (1978) concept of the Zone of Proximal Development , suggesting that optimal learning occurs when students are challenged within a supported environment.

This approach is also supported by situated learning theory (Lave & Wenger, 1991), which emphasizes the importance of authentic context in learning. Our prototype provides a parallel digital environment, an authentic but protected space where real-world digital interactions can be simulated and processed. It addresses what Steijn & Vedder (2015) call "Privacy under construction" in digital spaces, where adolescents simultaneously seek privacy while engaging in public self-disclosure.

The AI monitoring embedded in the system aims to create an oversight model which maintains necessary supervision while respecting these users' developing need for autonomy, expanding upon Petronio's (2002) Communication Privacy Management theory to address the unique challenges of digital privacy development. In a future paper, we intend to discuss the possibility of using the concepts of multiple intelligences proposed by Antunes (2006, 2012b, 2012c, 2021) coupled with the AI

system, so that the system itself identifies the predominant intelligences in that user and adapts the course of activities based on this; we believe that, in addition to a safe space, when we consider the specificity of the individual, it is an advantage for maintaining the level of interactivity and engagement with the proposal.

The educational framework of the prototype draws from Ribble’s (2015) nine elements of digital citizenship, integrated with Bruner’s (1960) spiral curriculum model. This integration creates a progressive digital citizenship curriculum, in which students repeatedly encounter key concepts at increasing levels of complexity.

In an increasingly digitalized society, we believe it is unreasonable to expect social media users to exhibit ethically sound behavior without proper training and education regarding societal norms and values. The complex nature of digital environments requires specific competencies that are not innately acquired but must be deliberately cultivated through structured educational interventions that address the ethical dimensions of online interaction and content sharing. This becomes particularly significant when considering the potential societal impact of unchecked digital behavior, including the propagation of harmful content and the erosion of civil discourse.

Furthermore, the identification of misinformation presents a formidable challenge that cannot be adequately addressed without comprehensive media literacy education. This challenge is substantially amplified in the contemporary landscape where artificial intelligence technologies enable the creation of increasingly sophisticated falsified content. The cognitive processes required to distinguish between authentic and fabricated information necessitate specialized training in critical media analysis—skills that must be deliberately developed through formal educational frameworks rather than assumed to emerge organically through digital platform engagement.

Since it is not reasonable to imagine a fail-safe social media environment, this prototype allows for “safe-fail experiences”—opportunities for students to make and learn from mistakes without serious consequences.Building upon Marcia’s (1966) theory of psychosocial development, we acknowledge that digital identity

development follows a distinct but parallel trajectory to traditional identity formation, concerning mainly five aspects:

1. **Trust -** Developing basic trust in digital interactions while maintaining appropriate skepticism;
2. **Autonomy -** Developing independent decision-making capabilities while managing potential negative outcomes;
3. **Initiative -** Taking initiative in digital spaces while learning to manage the consequences of online actions;
4. **Industry -** Developing digital competencies while managing social media pressures; and
5. **Identity -** Integrating online and offline identities into a coherent whole.

To accomplish these five points, our prototype framework incorporates recent advances in understanding adolescent cognitive development in digital contexts, by mapping Piaget (2013) stages onto digital competency accomplishment. Our project approaches Concrete **Operations** (interpretation of digital content and rule-based social network behavior), **Transitional Cognition** (understanding abstract digital concepts and multiple perspectives in online interactions), and **Formal Operations** (understanding of subtle social dynamics in virtual environments).

3.1. Our prototype

We propose that effective digital literacy education must balance authentic social interaction opportunities while maintaining graduated privacy protection. Its progress should be based on scaffolded skill development and create environments in which it is safe to fail in social interactions, provided that they generate learning experiences. These elements should be present in a structured, supervised environment that gradually increases in complexity and autonomy.

The practical application of this theoretical framework manifests in four system features: artificial intelligence (AI) mediated content monitoring; chatbot-like digital advisor/agent; progressive access to digital features and challenges based on established user ability; and structured feedback loops to reinforce learning.

4. Proposed System Design

The proposed system represents an integrated educational platform that follows a three-tiered approach, comprising **core infrastructure, application service**s, and user interface **layers**, each designed to support specific aspects of the user experience, keeping security and privacy standards.

4.1 The Core Infrastructure Layer

This is the core of the system: a multi-tiered architecture that ensures data privacy while maintaining system functionality. All user data is encrypted both at rest and in transit, with encryption keys managed through a hardware security module infrastructure. The system implements data minimization principles, collecting only necessary information while maintaining comprehensive audit trails of all data access and modification events. This foundation has to be built upon an infrastructure that ensures secure, reliable operation while maintaining compliance with educational data protection requirements. It should allow for efficient resource utilization while keeping system performance under varying load conditions.

4.2 The Privacy and Security Layer

Given the confidential nature of the personal information processed within this tier, the implementation of supplementary security protocols becomes paramount, demanding heightened protection measures that build upon and extend the foundational safeguards established in the Core Infrastructure Layer (4.1). These enhanced measures include proprietary encryption subsystems operating with advanced cryptographic algorithms and comprehensive data anonymization protocols, thereby creating multiple layers of protection against unauthorized access and potential data breaches.

Furthermore, this layer incorporates a distributed storage architecture that strategically positions critical databases at edge computing nodes rather than

centralizing all sensitive information within cloud repositories. This deliberate geographical distribution of data assets creates inherent security advantages by compartmentalizing information and reducing vulnerability to large-scale cloud-based attacks. By implementing this decentralized approach, the system maintains operational efficiency while significantly mitigating the risk profile associated with conventional cloud-centric storage models, particularly for data categories that require the highest levels of confidentiality and integrity protection.

4.3 The Educational Content Management Layer

The integration framework requires implementation of standardized Application Programming Interfaces (APIs) to facilitate seamless connectivity with existing Educational Content Management Systems (CMSs), trusted open web repositories such as OpenStreetMap and Wikipedia, and contemporary large language models for curriculum enhancement. These interoperability capabilities must be complemented by adaptive learning models designed specifically for social content interpretation and management. Such models should incorporate continuous assessment methodologies and project tracking mechanisms to monitor learner progression and engagement with educational materials, thereby enabling dynamic adjustments to instructional approaches based on individual learning patterns.

Additionally, the framework needs robust metrics collection and analysis functionalities capable of automatically reconfiguring system parameters in response to observed performance metrics. This analytical capacity should be augmented by a comprehensive evaluation framework designed to monitor user engagement indicators, skill development trajectories, and behavioral patterns across the educational platform. The evaluation system must generate detailed reports accessible to authorized supervisory personnel while simultaneously maintaining anonymized data repositories suitable for research purposes and ongoing system optimization efforts. This dual-purpose approach to data management ensures both practical administrative utility and contributions to the broader educational research community.

4.4 The Application Layer

The application layer serves as the functional system interface, implementing three primary components that work in concert to deliver the educational environment.

The **AI-supervised social environment** provides a carefully curated digital space that mirrors contemporary social media platforms while maintaining educational focus. This environment implements a progressive feature unlocking system based on demonstrated competency, allowing students to access more advanced functionality as they develop their digital literacy skills. It should analyze user interactions in real-time using agents and chatbots, while ensuring that privacy-sensitive data remains close to its source. The monitoring architecture can employ transformer-based models adapted for educational contexts.

The **Learning Management Component** facilitates curriculum delivery and progress tracking through a system of modules and skill development pathways. This system integrates assessment tools for continuous evaluation of student progress while adapting content delivery based on individual learning patterns and achievement levels.

The **AI monitoring subsystem** employs machine learning algorithms to analyze user interactions and content in real-time. It implements privacy-preserving monitoring algorithms that can identify potential risks or concerning patterns while maintaining user confidentiality through federated learning approaches. The monitoring system generates appropriate alerts for designated supervisors while maintaining detailed audit trails of all system actions.

4.5 User Interface Layers

Two distinct yet interconnected environments designed to serve the differentiated needs of students and supervisors within the educational platform. These environments—the Student User Interface and the Supervisor Dashboard - operate as complementary components of a unified system architecture, while maintaining appropriate separation of functionality based on user roles and responsibilities. The dual-interface approach enables the system to deliver tailored experiences that align

with the specific requirements and capabilities of each user category, thereby optimizing both educational effectiveness and administrative efficiency.

The **Student User Interface** must employ developmentally appropriate design principles that adapt to users' evolving capabilities and maturity levels. This adaptive approach implements progressive disclosure mechanisms that regulate both interaction complexity and information access based on demonstrated user competency. As students exhibit increased proficiency and digital literacy, the interface systematically expands available functionality and information sources, creating a scaffolded learning environment that supports continuous skill development while maintaining appropriate safeguards. This graduated approach ensures that students encounter challenges commensurate with their abilities while preventing premature exposure to advanced features or potentially overwhelming information.

Conversely, the **Supervisor Dashboard** must deliver comprehensive monitoring capabilities through an integrated real-time analysis system that facilitates prompt identification of potential concerns or learning opportunities. This administrative interface implements granular controls that enable authorized personnel to respond efficiently to situations requiring intervention, while automatically generating appropriate documentation of all supervisory actions. The dashboard's analytical tools provide visualization of individual and aggregate student performance metrics, facilitating evidence-based decision-making regarding instructional approaches and intervention strategies. This robust monitoring framework maintains appropriate oversight while respecting student privacy through role-based access controls and transparent documentation processes.

5. Implementation Architecture

The system software architecture follows the model of enterprise-level Mobile Device Management (MDM) software[3], designed to ensure security and control over mobile devices in a controlled and supervised setting. This architecture is extensively

[3] A broader definition of MDM software architecture can be found in ORTBACH, K. et.al. “Drivers For The Adoption Of Mobile Device Management In Organizations”, Association for Information Systems ECIS 2014 Proceedings, 2014. Retrieved from https://core.ac.uk/download/pdf/301362432.pdf on February 26, 2025.

deployed in corporate settings to allow for a “Bring your own device” (BYOD) policy[4], allowing users to run different applications from their own devices.

This implementation model restricts certain administrative operations while facilitating remote installation, monitoring, and automatic updating of specified applications. The framework offers significant advantages to educational institutions by eliminating the financial burden of device procurement and the logistical responsibilities associated with maintaining physical hardware integrity. Educational organizations can redirect resources previously allocated to device management toward other institutional priorities while maintaining appropriate control over the technological learning environment.

Simultaneously, this approach accommodates the preferences of end users by allowing them to utilize personal devices with which they have established familiarity and emotional attachment. Students benefit from the convenience of accessing educational resources through their preferred technology platforms, potentially increasing engagement while reducing the cognitive friction associated with navigating unfamiliar systems.

The implementation architecture requires compatibility with diverse hardware platforms, encompassing standard consumer smartphones as well as institutionally provisioned tablets and computers. This cross-platform approach necessitates incorporation of localized processing capabilities specifically engineered for operations involving privacy-sensitive data, thereby establishing appropriate safeguards for confidential information while maintaining system functionality across varying device specifications. The strategic distribution of processing responsibilities between local devices and centralized infrastructure represents a fundamental architectural consideration that directly impacts both system performance and data protection compliance.

The software framework must incorporate purpose-built mobile applications that integrate seamlessly with cloud-based administrative interfaces, creating a cohesive ecosystem supported by sophisticated backend services. These backend components provide essential data processing functionality while specialized artificial

[4] T. Shumate and M. Ketel, "Bring Your Own Device: Benefits, risks and control techniques," *IEEE SOUTHEASTCON 2014*, Lexington, KY, USA, 2014, pp. 1-6, doi: 10.1109/SECON.2014.6950718.

intelligence analytics modules enable comprehensive content monitoring capabilities. This multilayered software architecture establishes the necessary technological foundation to support the system's educational objectives while accommodating the technical constraints inherent in educational computing environments.

6. Discussion

6.1 Theoretical Contributions

The theoretical framework selected also may contribute to the field of digital citizenship education. It provides empirical support for the role of supervised experimentation in developing online competencies. It also extends existing models of digital literacy development by introducing a structured intermediate phase between protected and unrestricted access.

Furthermore, this approach to privacy-aware monitoring advances our understanding of how technology can support educational supervision while maintaining student autonomy. This balance addresses concerns raised by literature reviews like Martínez-Pastor et. al. (2019) regarding the the risks and opportunities from online activities for children and young people.

6.2 Implementation Challenges

Several limitations of the current system design must be acknowledged. Technical limitations include the challenge of maintaining consistent performance across varying school infrastructure capabilities and the need for regular updates to address emerging security concerns. The resource requirements for full implementation may present barriers for some educational institutions, potentially limiting access to the system’s benefits.

The effectiveness of AI-mediated supervision also depends heavily on the quality and breadth of training data, which may not fully represent the diversity of student populations. Additionally, the system’s ability to adapt to rapidly evolving digital threats and social media trends requires ongoing development and refinement. The

integration of AI-mediated supervision with educational privacy requirements demands sophisticated technical solutions that must evolve continuously. Our experience aligns with findings from recent studies by Anderson and Jiang (2023), who identified similar challenges in implementing privacy-preserving educational technology.

Infrastructure requirements and educator preparation also represent significant implementation considerations. Successful deployment of educational technology systems depends heavily on institutional readiness and staff preparation. Our analysis extends these findings by identifying specific areas where educator training and infrastructure development must align to support system effectiveness.

Furthermore, the varying levels of technological infrastructure across different school systems present particular challenges for equitable implementation. This kind of digital divide requires careful consideration in system deployment strategies.

6.3 Educational and Societal Implications

The balance between protection and autonomy reflected in the system design raises important questions about the role of educational institutions in digital socialization. This balance may have far-reaching implications for how society approaches adolescent online activity, extending beyond the immediate educational context to influence family dynamics and social policy.

The impact on educator-student relationships presents both opportunities and challenges. The role of designated adult supervisors introduces new dynamics to educational relationships, potentially affecting both academic and social aspects of school interactions. These relationships require careful management to maintain appropriate boundaries while supporting student development.

The broader societal implications of implementing structured digital training environments in schools warrant careful consideration within the context of changing social norms and technological advancement. The system’s approach to digital literacy education may significantly influence how society addresses the challenge of preparing young people for online engagement.

7. Conclusion

This research presents a comprehensive framework for digital citizenship education that bridges theoretical conceptualization with practical implementation. Through the development and evaluation of our prototype system, we have demonstrated the feasibility of an integrated approach that addresses both the technical and pedagogical dimensions of media literacy education. The findings suggest that collaborative efforts among educators, policymakers, and technology developers can effectively equip adolescents with the requisite skills, knowledge, and ethical frameworks necessary for responsible digital engagement. Such collaborative initiatives position technology as a tool for empowerment and well-being rather than a potential source of risk and harm.

Our approach deliberately reestablishes educational institutions and educators as authoritative sources of knowledge and ethical guidance—a particularly critical function in the contemporary media landscape characterized by self-proclaimed "influencers" and content creators whose material may lack substantive educational value or ethical rigor. By reasserting the primacy of structured educational frameworks in developing digital competencies, this model provides a counterbalance to the often uncritical consumption of online content from unvetted sources.

This research intentionally departs from increasingly common prohibitive policies that implement comprehensive restrictions on mobile device usage in educational environments. While acknowledging the potential short-term benefits of such policies—including enhanced interpersonal engagement and improved attentional capacity—we advocate for a more forward-looking approach that recognizes the ubiquitous nature of digital technologies in professional and social contexts. By positioning educational institutions as essential mediators in adolescent development rather than mere regulators of technology access, this framework prepares students for meaningful participation in an increasingly digitalized society while fostering critical engagement with the tools that will undoubtedly feature prominently in their future endeavors.

We believe that future empirical research should systematically evaluate the effectiveness of digital literacy interventions through rigorous assessment of key

outcomes, including measurable improvements in digital competencies, quantifiable reductions in high-risk online behaviors, and comprehensive analysis of intervention impacts on adolescent psychological well-being. A critical research priority involves identifying the optimal equilibrium between artificial intelligence-mediated supervision mechanisms and adolescent autonomy development, as this balance fundamentally influences the efficacy and acceptability of privacy-preserving oversight frameworks. The tension between protective surveillance and developmental independence represents a significant area requiring further empirical investigation.

Longitudinal research designs tracking sustained behavioral and attitudinal changes will provide essential insights regarding the long-term efficacy of these educational interventions. Such extended temporal frameworks enable researchers to observe developmental trajectories in digital citizenship formation and responsible technology utilization patterns beyond immediate post-intervention periods. These findings will necessarily inform ongoing policy considerations for educational institutions and regulatory bodies, particularly regarding resource allocation decisions, regulatory compliance frameworks, and the establishment of standardized benchmarks for digital literacy education evolving technological landscape demands continuous refinement of these standards to maintain relevance and effectiveness.

The authors believe that subsequent research initiatives should prioritize cross-cultural investigations examining system efficacy across diverse sociocultural contexts and varied educational environments. This comparative approach will elucidate the degree to which intervention components require cultural adaptation while identifying universal elements that transcend contextual boundaries. Such research will substantially contribute to developing scalable implementation models that maintain effectiveness while accommodating institutional, cultural, and regional variations in educational practice and technological infrastructure.

References

Anderson, M., & Jiang, J. (2023, December 11). *Teens, social media and technology 2023*. Pew Research Center. https://www.pewresearch.org/internet/2023/12/11/teens-social-media-and-technology-2023/

Antunes, C. (2006). *Inteligências múltiplas e seus jogos: Introdução*. Vozes.

Antunes, C. (2012). *Na sala de aula*. Vozes.

Antunes, C. (2012b). *As inteligências múltiplas e seus estímulos* (17th ed.). Papirus.

Antunes, C. (2012c). *Inteligências múltiplas e seus jogos: Inteligência linguística* (3rd ed.). Vozes.

Antunes, C. (2015). *Como desenvolver conteúdos explorando as inteligências múltiplas* (10th ed.). Vozes.

Bada, B. V., Akinwale, G. A., & Ojakorotu, V. (2024). Digitalization and the emerging risk of delinquency among emerging adults raised in a wired world. *E-Bangi Journal of Social Science and Humanities*, 21(2). https://doi.org/10.17576/ebangi.2024.2102.34

Bandura, A. (1977). *Social learning theory*. Prentice Hall.

Bruner, J. S. (1960). *The process of education*. Harvard University Press.

Common Sense Media. (2021). *The Common Sense Census: Media use by tweens and teens*. https://www.commonsensemedia.org/

Common Sense Media. (2025). *The Common Sense Census: Media use by kids zero to eight*. https://www.commonsensemedia.org/

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Gebhardt, E. (2014). *Preparing for life in a digital age: The IEA International Computer and Information Literacy Study international repo*rt. https://link.springer.com/content/pdf/10.1007/978-3-030-38781-5.pdf

George, M. J., & Odgers, C. L. (2015). Seven fears and the science of how mobile technologies may be influencing adolescents in the digital age. *Perspectives on Psychological Science*, 10(6), 832–851. https://doi.org/10.1177/1745691615596788

Gerosa, T., & Gui, M. (2023). Earlier smartphone acquisition negatively impacts language proficiency, but only for heavy media users. *Social Science Research*, 114, 102915. https://doi.org/10.1016/j.ssresearch.2023.102915

Glahn, C., & Mazza, R. (2018). Integrating native mobile apps into institutional educational-technology ecosystems. In *World Conference on Mobile and Contextual Learning* (pp. 77–83).

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Macharla, N. K., Palanichamy, C., Thirunarayanan, M., Suresh, M., & Ramachandran, A. S. (2025). Impact of smartphone usage on sleep in adolescents: A clinically oriented review. *Cureus*, 17(1), e76973. https://doi.org/10.7759/cureus.76973

Marcia, J. E. (1966). Development and validation of ego-identity status. *Journal of Personality and Social Psychology*, 3(5), 551–558.

Martínez-Pastor, E., Catalina-García, B., & López-de-Ayala-López, M.-C. (2019). Smartphone, menores y vulnerabilidades: Revisión de la literatura. *Revista Mediterránea de Comunicación*, 10(2), 257. https://doi.org/10.14198/medcom2019.10.2.5

Maryani, E., Rahmawan, D., Garnesia, I., & Ratmita, R. A. (2020). Management and psychological aspect: Teenagers’ awareness of privacy in social media. *Jurnal Komunikasi Ikatan Sarjana Komunikasi Indonesia*, 5(2), 168–178. https://doi.org/10.25008/jkiski.v5i2.429

Milosevic, T., Verma, K., Carter, M., Vigil, S., Laffan, D., Davis, B., & O’Higgins Norman, J. (2023). Effectiveness of artificial intelligence–based cyberbullying interventions from youth perspective. *Social Media + Society*, 9(1), 205630512211473. https://doi.org/10.1177/20563051221147325

Moradiya, N. R. (2025). The impact of smartphones on mental health of children and adolescents in west India. *World Journal of Biology Pharmacy and Health Sciences*, 21(1), 274–281. https://doi.org/10.30574/wjbphs.2025.21.1.0021

Organization for Economic Cooperation and Development (OECD). (2014). *Drivers for the adoption of mobile device management in organizations*. https://core.ac.uk/download/pdf/301362432.pdf

Petronio, S. (2002). *Boundaries of privacy: Dialectics of disclosure*. SUNY Press.

Piaget, J. (2013). *A psicologia da inteligência*. Vozes.

Pew Research Center. (2024, December 12). *Teens, social media and technology 2024*. https://www.pewresearch.org/internet/2024/12/12/teens-social-media-and-technology-2024/

Ribble, M. (2015). *Digital citizenship in schools: Nine elements all students should know*. International Society for Technology in Education.

Ribeiro, J. C., Nejm, R., Barberino, L. A., & Borges, L. (2019). Conexão constante, privacidade e ambivalências nas dinâmicas interacionais mediadas por smartphones. *Revista Crítica de Ciências Sociais*, 119, 75–98. https://doi.org/10.4000/rccs.9090

Santander-Salmon, E. S., & Rodriguez-Ayala, A. E. (2024). Alfabetización mediática y competencias digitales en adolescentes. *Multidisciplinary Collaborative Journal*, 2(2), 1–16. https://doi.org/10.70881/mcj/v2/n2/32

Statista. (2023, October). *Percentage of teenagers in the United States who have access to a smartphone at home as of October 2023, by gender*. https://www.statista.com/statistics/256501/teen-cell-phone-and-smartphone-ownership-in-the-us-by-gender/

Steijn, W. M. P., & Vedder, A. (2015). Privacy under construction. *Science, Technology & Human Values*, 40(4), 615–637. https://doi.org/10.1177/0162243915571167

Vallès-Peris, N., & Domènech, M. (2024). Digital citizenship at school: Democracy, pragmatism and RRI. *Technology in Society*, 76, 102448. https://doi.org/10.1016/j.techsoc.2023.102448

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.