

THE IMPORTANCE OF A SAFE DIGITAL-DEVELOPMENTAL ENVIRONMENT IN DEVELOPING COMPUTER LITERACY AMONG CHILDREN IN SCHOOL PREPARATORY GROUPS

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Abstract

The increasing presence of digital technologies in early childhood has created new educational opportunities while simultaneously introducing challenges related to children's safety, well-being, privacy, attention, and development. For children in school preparatory groups, computer literacy should therefore be developed not only through access to digital devices but within a carefully designed digital-developmental environment that combines learning opportunities with protection, adult guidance, and developmentally appropriate limits. This article examines the pedagogical importance of a safe digital-developmental environment in developing computer literacy among children aged approximately 6–7 years. The study applies theoretical analysis, comparative synthesis, content analysis, and pedagogical modelling to recent research and international recommendations published between 2021 and 2025. The analysis identifies five interconnected dimensions of a safe digital-developmental environment: pedagogical-purposefulness, content and technical safety, digital well-being, adult mediation, and child-oriented digital responsibility. A methodological model is proposed in which safe access, guided exploration, purposeful interaction, creative digital activity, reflection, and responsible behavior are integrated into preschool computer-literacy development. The findings indicate that children's digital competence develops more sustainably when educational technologies are selected according to pedagogical objectives, adult mediation is continuous but non-controlling, privacy and online-safety principles are introduced through concrete situations, and digital activities remain balanced with movement, play, communication, books, art, and real-world exploration. The study concludes that a safe digital environment should not be interpreted as the complete elimination of digital risks but as a developmental system in which children gradually learn to benefit from digital opportunities while recognizing and managing age-appropriate risks.

Keywords: safe digital environment, developmental digital environment, computer literacy, preschool children, digital safety, digital well-being, school readiness, digital competence, parental mediation, early childhood education.

Introduction

Digital technologies are becoming part of children's everyday experience at increasingly early ages. Before entering primary school, many children already encounter smartphones, tablets, televisions connected to online services, interactive displays, digital toys, cameras, computers, and voice-controlled technologies. This reality changes the responsibilities of preschool education. Educational institutions can no longer treat digital competence as a skill that will begin to develop only after formal schooling. At the same

time, simply increasing children's access to technology cannot be regarded as an adequate educational response.

The central challenge is to create conditions under which children learn to use digital tools purposefully, safely, creatively, and responsibly.

This challenge is particularly relevant for children in school preparatory groups, generally around 6–7 years of age. At this stage children become increasingly capable of following multistep instructions, planning simple actions, explaining their decisions, recognizing rules, and understanding elementary cause-and-effect relationships. These developmental changes create favorable conditions for the formation of foundational computer literacy.

Nevertheless, children of this age remain highly dependent on adult guidance. Their capacity to evaluate commercial content, recognize manipulation, understand privacy risks, manage screen use independently, or assess the reliability of digital information remains limited. Consequently, digital competence and digital protection cannot be separated.

International frameworks increasingly define digital competence as a combination of knowledge, skills, and attitudes required for confident, critical, responsible, and safe participation in digital environments. DigComp 2.2, for example, includes information and data literacy, communication and collaboration, digital-content creation, safety, and problem-solving as interconnected areas [1]. It also emphasizes privacy, data protection, well-being, accessibility, and responsible engagement with emerging technologies.

For preschool education, these broad areas need to be translated into age-appropriate behaviors. A six-year-old child does not need an abstract lesson on data governance. The same principle may instead be expressed through a simple rule: *“Do not give your name, address, photograph, or password to an unfamiliar person or application without asking an adult.”*

Similarly, digital well-being does not require children to understand complex psychological models. It begins with practical habits such as taking breaks, maintaining appropriate posture, moving after digital activity, recognizing tiredness, and understanding that a device should not replace play, sleep, conversation, or outdoor activity.

The concept of a safe digital-developmental environment therefore extends beyond conventional internet safety.

In the present study, a safe digital-developmental environment is understood as a purposefully organized combination of:

- appropriate digital technologies;
- safe and age-appropriate content;
- pedagogically meaningful activities;
- adult guidance and mediation;
- physical and psychological well-being measures;
- privacy and data-protection practices;
- opportunities for creative and active digital participation;
- balanced integration of digital and non-digital experiences.

This definition is important because safety in education should not be understood only through restriction.

A completely risk-free digital environment is practically impossible, and excessive restriction may prevent children from developing the skills necessary to navigate technology responsibly. UNICEF's recent work on children's digital lives similarly stresses that technology can generate both opportunities and risks and that the goal should be to enable children to build digital skills while remaining protected from harmful experiences [2].

Thus, the purpose of a safe environment is not to remove children's agency but to support age-appropriate agency within protective boundaries.

Recent research on digital competence in early childhood supports this multidimensional perspective. Su and Yang's systematic review of 23 studies found that early-childhood digital competence has been conceptualized through knowledge, abilities, attitudes, learning outcomes, and contextual conditions rather than technical operation alone [3].

Masoumi and Bourbour similarly argue that adequate digital competence in early childhood includes technological familiarity, experimentation, problem-solving, critical attitudes, ethical awareness, and productive use of digital resources [4]. Their findings are particularly relevant because they demonstrate that the ability to act safely and responsibly should be considered part of competence rather than an external restriction placed on technology use.

The growing research on digital well-being further broadens the discussion. Cao and Li reviewed 35 studies addressing digital well-being in early childhood and concluded that children's digital experiences are shaped by both child-related and parent-related factors, including duration and context of use, adult digital behavior, parental perceptions, and mediation [5].

This finding is pedagogically important. A device itself is neither educational nor harmful in a fixed sense. Its developmental effect depends partly on what children do with it, how long they engage, whether an adult is present, what content is involved, and what activities the technology replaces.

For example, twenty minutes spent collaboratively creating a digital story with a teacher may involve speech, imagination, sequencing, problem-solving, and social interaction. The same amount of time spent passively watching automatically selected short-form videos produces a fundamentally different developmental experience.

Therefore, the frequently used category of screen time cannot independently describe the educational quality of digital experience.

Ponti's updated review on screen use among preschool children similarly emphasizes the importance of minimizing unnecessary screen exposure while also mitigating risks, using media mindfully, and modelling healthy digital behavior [6].

For the school preparatory group, this suggests that teachers should consider several questions before introducing digital technology:

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What is the learning objective?

Why is a digital tool preferable for this particular activity?

Will the child be active or passive?

Does the content contain advertising, distracting links, or inappropriate information?

Does the activity require communication or cooperation?

What happens before and after the digital activity?

How long should the activity last?

Will children have an opportunity to reflect on what they did?

These questions transform digital-safety management from a purely technical task into a pedagogical process.

Another central issue is child online protection. As education systems integrate digital learning, protecting children from inappropriate content, privacy violations, unwanted communication, and other online risks becomes part of educational responsibility. UNICEF's guidance on child online protection in digital learning explicitly argues that protection should be integrated into the design and implementation of digital education rather than treated as a separate response after harm has occurred [7].

This idea is particularly valuable for early childhood education.

A preschool institution should not first introduce children to digital environments and only later explain safety. Safety should be built into the environment from the beginning.

For example, age-appropriate software should be preselected.

Advertising and external links should be minimized or disabled.

Children should not need to enter unnecessary personal information.

Teacher accounts should be used where possible rather than individual child accounts.

Photographs and recordings involving children should be managed according to consent and institutional privacy rules.

Devices should be physically positioned so that teachers can support rather than secretly monitor children's activity.

Such decisions create what can be described as safety by pedagogical design.

The social environment is equally important.

Children learn digital behavior by observing adults. If educators constantly use phones during communication, children receive one message about technology regardless of formal rules. If adults ask permission before taking photographs, protect private information, take breaks, and use technology purposefully, children observe an alternative model.

Digital safety therefore involves modelling as well as instruction.

Parental mediation also plays a major role because children's digital experiences extend beyond preschool institutions. Recent research on family digital environments indicates that parental strategies influence young children's access, engagement, protection, and early digital literacy development [8].

A preschool institution cannot directly control the home digital environment, but it can support families through clear, non-judgmental guidance.

Parents can be encouraged to:

- use digital technologies together with children when possible;
- discuss what children see;
- establish predictable routines;
- avoid devices during meals and bedtime routines;
- protect passwords and personal information;
- select age-appropriate content;
- encourage digital creation rather than endless consumption;
- model respectful technology use.

The relationship between digital opportunity and digital risk also has an equity dimension. UNICEF's 2025 *Childhood in a Digital World* report highlights persistent inequalities in access to digital technologies and digital skills [2]. A child with limited home access may need more opportunities to develop basic competence in preschool, while a child with constant access may require greater support in self-regulation and purposeful use.

Thus, “more technology” and “less technology” cannot be universal educational prescriptions.

Different children may need different forms of support.

The scientific problem addressed in this article arises from the fact that computer-literacy programs sometimes emphasize device operation while treating safety, well-being, privacy, and adult mediation as secondary topics. Such separation limits the educational value of digital learning.

The present study argues that a safe digital-developmental environment should be understood as a precondition and component of computer literacy itself.

Accordingly, the purpose of this study is to theoretically substantiate the importance of a safe digital-developmental environment for developing computer literacy among children in school preparatory groups and to identify pedagogical conditions for its effective organization.

The following research objectives were established:

1. to clarify the structure of a safe digital-developmental environment in preschool education;
2. to determine the relationship between digital safety and computer literacy;
3. to identify major risks and developmental opportunities associated with young children's digital activity;
4. to define the roles of teachers and families in mediating children's digital experience;
5. to develop a practical model for organizing safe and developmentally appropriate digital learning.

Materials and Methods

The study was conducted as a theoretical and analytical investigation based on recent peer-reviewed research and international educational and child-protection frameworks published primarily between 2021 and 2025.

The methods included theoretical analysis, comparative analysis, content analysis, classification, synthesis, and pedagogical modelling.

The literature was examined according to four analytical categories:

- digital competence;
- digital safety and child protection;
- digital well-being;
- early-childhood digital pedagogy.

The research did not involve direct experimentation with children or collection of personal data. Therefore, no empirical claims concerning intervention effect sizes were generated.

Results

The analysis identified five interrelated dimensions that should be present in a safe digital-developmental environment.

Every digital activity should be connected with an explicit developmental or educational objective.

Technology should not be used merely because equipment is available.

For example, if the purpose is to develop sequencing, a programmable toy may offer a meaningful advantage.

If the purpose is sensory exploration, real objects may be more appropriate.

If the aim is cooperative storytelling, a digital storytelling tool can be valuable when it enables children to combine drawings, photographs, and voice recordings.

Thus, the first safety principle is surprisingly pedagogical: unnecessary technology should not be introduced.

Reducing purposeless digital use naturally reduces exposure to unnecessary risks.

The second dimension concerns the safety of devices, software, and content.

For 6–7-year-old children, a safe digital environment should preferably include:

- educator-selected applications;
- limited or disabled advertising;
- no unnecessary external hyperlinks;
- minimal personal-data collection;
- age-appropriate language and imagery;
- protected accounts and passwords;
- restricted download permissions;
- secure network settings.

The OECD's revised typology of digital risks emphasizes that children may encounter diverse content, conduct, contact, consumer, privacy, and security risks in digital environments [9].

For preschool children, adults remain responsible for managing most of these risks. However, children can begin to learn simple recognition and response strategies.

The third dimension concerns the child's physical, emotional, and social well-being.

Digital learning should not systematically replace movement, sleep, play, face-to-face communication, creative manipulation, or outdoor experiences.

A safe digital-developmental environment therefore includes:

- appropriate duration of digital activity;
- breaks between screen-based tasks;
- correct seating and device positioning;
- sufficient movement;
- reduced distracting stimulation;
- attention to emotional reactions;
- transition back to physical activity.

Cao and Li emphasize that digital well-being in early childhood cannot be reduced to one measure; the quality, context, and mediation of children's digital experiences also matter [5].

The fourth dimension is teacher and parent mediation.

A child should neither be left alone with digital technology nor have every action controlled.

Effective mediation occupies the middle position.

The adult:

- explains;
- asks questions;
- models safe behavior;
- supports problem-solving;
- observes;
- sets boundaries;
- gradually transfers appropriate responsibility.

This can be expressed through the sequence: adult control → guided participation → shared responsibility → age-appropriate independence.

The fifth dimension concerns children's emerging responsible behavior.

At age 6–7, children can begin to understand several simple rules:

1. Ask before sharing.
2. Keep personal information private.
3. Do not click unfamiliar links.
4. Tell an adult if something feels wrong.
5. Treat devices carefully.
6. Be respectful to other people online and offline.
7. Technology has a purpose; it is not required for every activity.

These rules represent the earliest foundations of digital citizenship.

Table 1. Structure of a safe digital-developmental environment

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Dimension	Main purpose	Practical indicator
Pedagogical purpose	Meaningful use	Technology is linked to a clear learning objective
Technical/content safety	Risk prevention	Age-appropriate, protected resources are used
Digital well-being	Healthy balance	Screen use is combined with movement and direct interaction
Adult mediation	Guided development	Teacher supports rather than merely controls
Digital responsibility	Child competence	Child follows basic safety and privacy rules

Based on the analysis, the following model is proposed: SELECT SAFELY → GUIDE → INTERACT → CREATE → PAUSE AND REFLECT → TRANSFER RESPONSIBILITY

The proposed model begins with the **Select Safely** stage, during which the teacher carefully chooses the device, application, digital content, and relevant settings before children begin the activity. This preliminary selection is important because the educator is responsible for ensuring that the technology is age-appropriate, pedagogically meaningful, and safe for children to use. The next stage, **Guide**, involves explaining both the learning task and the safety rule connected with it. In this way, children understand not only what they are expected to do but also how to behave responsibly while using the digital tool.

The **Interact** stage focuses on active participation. Children should manipulate digital information, make choices, respond to prompts, and solve simple tasks instead of merely watching content passively. This active involvement helps transform technology from a source of entertainment into a learning tool. The following stage, **Create**, encourages children to produce something of their own. Depending on the activity, this may include a drawing, a short story, a sequence of actions, a photograph, an audio recording, or a simple solution to a problem. Creative production strengthens children's sense of agency and helps them understand that digital technologies can be used not only for consumption but also for expression and problem-solving.

After the digital activity, the model includes a **Pause and Reflect** stage. At this point, children are given a short opportunity to discuss what they did, what they found difficult, and what they learned. The educator may ask questions such as, "What did the computer help us do?", "Was anything difficult?", "What should we never share online?", or "What should we do if we see something strange?" Such questions help children connect practical experience with basic principles of digital responsibility and safety. Finally, the **Transfer Responsibility** stage involves gradually giving children greater independence as their competence develops. Adults continue to provide boundaries and supervision, but children are increasingly encouraged to make simple decisions on their own within a safe and controlled environment. In this way, safety becomes an integral part of digital learning rather than a separate instruction added only at the end of the activity.

Scenario-based learning can further strengthen this process because it allows children to practice safe decision-making in situations that resemble real digital experiences. For example, if a game asks a child to enter a home address, the educator can ask what the child should do. The expected response is that the child should consult a trusted adult and avoid entering personal information independently. In another situation, a child may want to upload a friend's photograph. The educator can use this example to explain that another person's image should not be shared without permission. Similarly, if an unfamiliar message appears on the screen, children can be taught not to open it immediately but to ask an adult for guidance. Through such practical scenarios, children learn to recognize potentially unsafe situations and respond appropriately. This method is more effective than simple memorization because it gives children an opportunity to apply safety rules through concrete choices and everyday examples.

Discussion

The findings suggest that the importance of a safe digital-developmental environment lies in its dual function: it protects children while simultaneously teaching them how to function competently in digital contexts.

This distinction is important because protective strategies based only on prohibition do not automatically create digital competence.

Children eventually encounter increasingly complex digital environments. Therefore, education should help them develop simple but transferable safety habits.

The findings correspond with DigComp 2.2, which treats safety as an integral component of digital competence rather than an external addition [1].

They also correspond with Su and Yang's systematic review, which confirms that digital competence in early childhood encompasses attitudes and responsible use alongside skills [3].

Another important implication concerns digital well-being. Recent evidence does not support reducing every discussion of children's technology use to a single quantitative measure. Context, content, interaction, adult mediation, and displacement of other activities all influence the developmental quality of digital experience [5], [6].

This means preschool institutions should avoid both extremes: uncontrolled technological saturation and complete digital avoidance.

The preferable approach is purposeful limitation combined with meaningful experience.

Teacher digital competence is also essential. A safe environment cannot be created by technical filters alone. The educator must know how to select resources, design interactive tasks, observe children's responses, protect privacy, communicate with parents, and model balanced use.

Recent research on early-childhood digital pedagogy increasingly identifies play-based, collaborative, project-based, and problem-based approaches as characteristic of stronger technology-integrated practice [10].

This reinforces the conclusion that safety and development should not be separated. The safest digital environment is not necessarily the one in which children do the least. It is the one in which children engage in well-selected, meaningful, supervised, creative, and balanced activity.

Conclusion

The development of computer literacy among children in school preparatory groups requires considerably more than providing access to computers, tablets, or educational applications. For digital learning to support children's development effectively, it should take place within a safe digital-developmental environment in which educational opportunities and child protection are considered as interconnected priorities. Such an environment should be organized purposefully and should combine pedagogical appropriateness, technical and content safety, digital well-being, adult mediation, and the gradual formation of responsible digital behavior.

The first important dimension is pedagogical purposefulness. Digital technologies should be used only when they serve a clear educational objective and contribute meaningfully to children's learning. Equally important are content and technical safety, which require educators to select age-appropriate applications, limit exposure to unsuitable material, protect children's personal information, and ensure secure use of devices. Digital well-being is another essential component, since technology use should remain balanced with movement, physical play, books, creative activities, communication, and exploration of the real world. Adult mediation also plays a central role because young children still need guidance in understanding digital situations, making decisions, and recognizing potential risks. At the same time, children should gradually develop digital responsibility by learning simple rules related to privacy, respectful communication, safe choices, and careful use of technology.

The proposed methodological sequence — Select Safely → Guide → Interact → Create → Pause and Reflect → Transfer Responsibility — provides a practical framework for integrating these dimensions into preschool education. At the beginning, the educator selects safe and developmentally appropriate resources and explains both the learning task and the relevant safety requirements. Children are then encouraged to interact actively with digital information rather than remain passive viewers. Whenever possible, they should also create something of their own, such as a digital drawing, story, photograph, recording, sequence, or simple solution to a problem. After completing the activity, reflection helps children understand what they learned, which difficulties they encountered, and what safety rules should be remembered. As their competence increases, adults can gradually provide opportunities for more independent decision-making while maintaining appropriate protective boundaries.

A developmentally appropriate digital environment should therefore perform two functions simultaneously. On the one hand, it should protect children from unnecessary exposure to inappropriate content, privacy risks, unhealthy digital habits, and excessive or purposeless technology use. On the other hand, it should create opportunities for children

to explore digital tools, solve simple problems, develop creativity, make choices, and understand the consequences of their actions. Protection should not eliminate meaningful digital participation; rather, it should create conditions in which such participation can occur safely.

The key pedagogical objective is therefore not to produce children who merely know how to operate digital devices. More importantly, preschool education should help children begin to understand when, why, and how technology can be used safely, responsibly, and meaningfully. When this understanding is developed together with practical computer skills, children acquire a stronger foundation for future digital learning.

Such an approach can support a smoother transition to technology-rich learning environments in primary school. It also contributes to the development of children who are not only technically confident but increasingly thoughtful, responsible, creative, and balanced in their interactions with digital technologies. In this sense, a safe digital-developmental environment should be regarded not as an additional protective measure but as an essential pedagogical condition for the formation of sustainable computer literacy in early childhood.

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