Design Guidelines for Parent-Child Joint Media Engagement

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Joint media engagement (JME), in which multiple people co-engage in a media experience, is an important media-use phenomenon, particularly when parents participate in children's engagement with learning technologies. To better understand and design for JME, HCI research has examined diverse forms of parent-child JME and proposed design guidelines to support productive JME in family contexts. However, these guidelines remain dispersed across the literature, and the lack of synthesis limits researchers' and practitioners' ability to design effective joint media experiences and technologies for families and beyond. Drawing on discrete JME design implications reported in HCI work on parent-child JME, we systematically develop 14 design guidelines clustered under four JME goals: supporting sustained individual engagement, supporting sustained co-engagement, supporting inclusive and ethical engagement, and promoting positive engagement outcomes. Each guideline is supported by a set of design strategies, situated in relevant media experiences and use contexts, as well as potential application tensions. Building on the synthesized guidelines, we further extend the conceptual framing of productive JME and reflect on the critical use of the developed guidelines.

CCS Concepts: • **General and reference → Design**; • **Human-centered computing → Collaborative and social computing design and evaluation methods**; **Collaborative interaction**.

Additional Key Words and Phrases: Joint Media Engagement, Design Implications, Parent-Child Interaction, Design Framework

ACM Reference Format:
Xiang Qi and Junnan Yu. 2026. Design Guidelines for Parent-Child Joint Media Engagement. *Proc. ACM Hum.-Comput. Interact.* 10, 6, Article CSCW070 (October 2026), 51 pages. https://doi.org/10.1145/3816918

1 Introduction

Joint media engagement (JME) refers to the phenomenon of multiple people using media together [132]. As the practice of co-using media has become prevalent, JME has drawn sustained attention from Human-Computer Interaction (HCI) scholars over the past decade, especially in family contexts between parents and children, given the important roles parents play in children's development. Parents may act as project collaborators, resource providers, and learning opportunity brokers [8, 149], and such involvement can enhance engagement and language skills [34]. Therefore, HCI research has examined diverse family media practices to understand parent–child interactions and to further support such joint media experiences [152], such as studies on investigating parental involvement in children's use of the Internet [92, 104], social media [55, 142], video games [89, 124], and educational technologies [151, 153].

The primary research and design goal for JME is to create and facilitate *"productive"* joint media experiences, i.e., media-based experiences that generate *"deeper understanding, inspiration, greater*

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ACM 2573-0142/2026/10-ARTCSCW070
https://doi.org/10.1145/3816918

fluency, and physical, emotional, or mental wellbeing than others" [132, p.43]. Designing for productive JME is important because not all JME are equal or welcoming for different participants. Some participants may be marginalized by partners with greater age or knowledge [132, 153]. Therefore, HCI scholars propose principles or guidelines for designing productive JME experiences and technologies, such as encouraging mutual engagement, facilitating dialogic inquiry, and supporting flexible interaction styles [83, 132]. Following Yvonne Rogers's framing [113], we used *"design guideline"* to refer to principles or recommendations derived from sources like empirical studies and expert experience that help designers create more effective, usable, and engaging designs [94, 135]. These guidelines, as heuristics, aim to bridge the gap between theory and practice, helping designers apply theoretical knowledge to real-world design problems [113]. Although many parent-child JME design guidelines have been developed and reported in HCI literature, designing productive family JME remains challenging because they have not been systematically synthesized yet. To apply these design guidelines, designers and practitioners often need to sift through a large volume of literature to locate relevant information, which can be inconvenient and impractical. That being said, we still lack a handy reference to many useful parent-child JME design guidelines shared in the HCI literature, let alone fully leveraging these design guidelines for designing productive JME experiences and technologies, which represents an important missed opportunity to benefit from the collective wisdom of HCI scholars. Aiming to bridge this practice gap, we ask: ***What are the design guidelines for parent-child joint media engagement?***

To answer the research question, we systematically searched for and collected parent-child JME literature within HCI, identified the papers ($N = 114$) that shared design implications, and synthesized the design implications into a comprehensive design guide for parent-child JME. Specifically, through our analysis of the extracted design implications, we derive four overarching design goals for JME, including *supporting sustained individual engagement, supporting sustained co-engagement, supporting inclusive and ethical engagement,* and *promoting positive engagement outcomes.* Structured by the four JME goals, we present 14 design guidelines synthesized from the literature, with each guideline situated in relation to relevant media[1] types, children's age groups, and associated design strategies and tensions. Building on these aspects, we further expand the conceptual framing of *productive JME as deepened and sustained joint media experiences in inclusive and ethical ways that lead to positive engagement outcomes.*

We mainly make two contributions to HCI communities interested in designing joint media experiences and technologies for families. First, we systematically synthesize and classify scattered design implications from parent-child JME literature in HCI into a taxonomy of higher-level goals and categories that can serve as a structured, accessible reference for JME-focused practitioners and researchers. Second, we expand the meaning of productive JME by articulating four high-level design goals grounded in our corpus, which together make design directions for JME researchers and practitioners more explicit.

2 Background & Related Work

This section introduces the background and related work of this paper, including JME framing and design principles, and parent-child interactions with technology. Additionally, because we aim to bridge the gap between JME researchers and practitioners by synthesizing relevant design guidelines, we include related work on translational research in HCI. Across these strands, we

[1]In line with JME scholarship where "media" is intentionally framed as an umbrella concept that captures a range of media types (e.g., [34, 132, 152]), we make explicit that media in JME refers to digital, screen-based, and networked technologies through which joint use occurs. Given this broad media spectrum and that many design guidelines are universally applicable across different media types, our analysis is organized by media type (for example, learning media, entertainment media, and information trackers) to preserve contextual differences rather than treating media as a monolith.

treat JME as the dominant conceptual lens that currently organizes much of the scholarship on parent-child media use in HCI, and we critically examine how this concept both enables and constrains the kinds of design guidance that are available to practitioners.

2.1 Joint Media Engagement and Design Principles

JME is rooted in research on parent-child interactions around technology and builds on *Parental Mediation Theory*, which describes how parents maximize benefits and minimize risks in children's media use [132, 150]. The theory comprises three types of parental mediation [23, 91, 138]: 1) *Restrictive mediation,* where parents regulate and set rules for children's media use; 2) *Active mediation,* where parents explain and discuss media content with their children; and 3) *Co-viewing* (or *co-using*), where parents join children's media use. Valkenburg et al. [138] developed *Parental Mediation Theory* in 1999 to describe parental involvement in children's television viewing. As media expanded to mobile devices, voice assistants, video games, and social media, the original theory became insufficient for today's fast-changing, intelligent, and networked ecology. Thus, media and HCI scholars have expanded or revised it (e.g., [23, 63, 92]). In the current era of pervasive, data-driven, and cross-platform media, parents and children negotiate media not around a single device but across interconnected ecologies of apps, services, and algorithms [152]. Such a shift makes it increasingly limiting to frame parental mediation only in terms of managing exposure or content, and it foregrounds the need for concepts that attend to the quality of joint activity, participation, and relationship-building around media rather than only individual screen time.

JME, introduced by Takeuchi and Stevens in 2011 as an expansion of the theory's *"co-viewing"* dimension [132], has been well received in HCI and is often used to describe parent-child co-engagement with technologies (e.g., [12, 13, 53]). Their report (i.e., [132]) is widely recognized as the first named articulation of JME and one of the earliest efforts to translate this concept into concrete principles for productive parent-child media use. This foundational status and sustained uptake make Takeuchi and Stevens' account a natural conceptual blueprint for our study and motivate our decision to foreground JME as the guiding lens. The subsequent widespread uptake has made JME a dominant framing for how HCI scholars conceptualize what it means for families to use media together, particularly in work that is interested in learning, social connection, and participation rather than only in regulation or restriction [34, 101, 152]. Although widely referenced, JME remains conceptual rather than theoretical [152]. A theory is a set of propositions that are logically related and explain relations among constructs [68, 72, 139]. While the current framing of JME (i.e., *"spontaneous and designed experiences of people using media together"* [132, p.9]) offers a foundation, it provides limited guidance and does not explicitly connect elements to specify JME types. Therefore, JME is still a concept and has yet to be theorized [152]. In this paper, we work with JME as a deliberately pragmatic lens: we build on its emphasis on joint activity and learning to organize the literature, while also making explicit where the existing conceptualization falls short for design.

When coining JME, Takeuchi and Stevens proposed six principles for designing productive JME [132]: 1) *Mutual engagement,* where all partners are motivated to participate regardless of age, knowledge, or proximity; 2) *Dialogic inquiry,* where partners collaboratively make meaning through communication; 3) *Co-creation,* where partners build things together rather than just consume; 4) *Boundary crossing,* where media connects to existing experiences and inspires new activities; 5) *Intention to develop,* where at least one partner aims for personal growth; and 6) *Focusing on content, not control,* where partners fully engage with content without distractions from technical features or facilitators. These principles span partner interactions, power dynamics, and learning goals. As such, some HCI scholars use these guidelines as an analytical framework to understand family joint media experiences (e.g., [13, 83, 124]). This explicit reuse indicates that, within JME-related writings, Takeuchi and Stevens' principles function as a shared reference point for HCI scholarship on productive JME rather than as just one set of recommendations among many. Nevertheless, the principles are not exhaustive, and as the media landscape expands, new JME forms continue to emerge [152]. Accordingly, new design guidelines keep appearing. For example, based on families' co-engagement in creative computing, Yu et al. [153] identified conditions such as supporting negotiation and self-advocacy.

In short, this emerging body of work suggests that JME is an important and timely concept for making sense of contemporary parent-child media practices, but that its associated design guidance is fragmented across studies, media types, and disciplinary conversations, limiting researchers' and practitioners' ability to leverage such HCI knowledge. To address this gap, the current work systematically examines design guidelines reported in parent-child JME literature within HCI, developing a comprehensive guide for parent-child JME design. By doing so, we not only catalog scattered recommendations but also surface cross-cutting tensions and tradeoffs that are central to how JME is, and could be, enacted in practice.

2.2 Parent-Child Interaction Around Technology

Parents and children interact around diverse media, a topic widely explored in HCI. The diverse media types include educational media like coding toys and kits [150], communication technologies like smart voice assistants [11, 60], entertainment media like video games [29], everyday devices like smartphones and tablets [119], and information trackers like physical activity trackers [117]. Such joint media experiences often yield positive outcomes, such as increasing family bonding [124], learning new knowledge of different domains [149], and improved self-management and reflection [115]. Therefore, it is critical to keep designing productive joint media experiences and technologies for families. However, simply enumerating media types and positive outcomes can obscure the fact that parent-child media practices are heterogeneous, situated, and often contested. What counts as a "productive" joint media experience can vary across families, cultures, and technologies, and even within the same household across time.

HCI scholars have therefore examined parent-child interactions with various media not only as sites of opportunity but also as sites of tension and negotiation [152]. For example, work on parental roles highlights how parents oscillate between being teachers, co-learners, and boundary-setters [30], often within the same interaction. Studies of tensions and negotiation surface conflicts between parents' desires to scaffold learning and children's needs for autonomy or play [153]. Research on cultural influence shows how norms around obedience, privacy, and academic achievement shape expectations for what JME should look like [148]. These perspectives reveal that joint media use is rarely neutral: it is patterned by power relations, values, and institutional pressures, and it can reproduce or challenge existing inequities. These rich perspectives also offer design guidelines for fostering productive JME that cover diverse aspects of joint media use, such as the tips to facilitate effective learning gains [77] and the need to respect children's data privacy [105]. Yet, because each study typically focuses on a particular medium, context, or tension, the resulting design implications are highly granular. Designers who want to support JME across media ecologies, or researchers who want to build on prior work, will have to navigate a fragmented body of guidance. Examining and synthesizing these existing but scattered design guidelines can provide valuable design references for JME researchers and practitioners. Accordingly, we aim to synthesize these design guidelines to provide a convenient design reference for those interested in supporting and creating productive JME experiences and technologies for families.

2.3 Translational Research in HCI

HCI researchers have long aimed to make their work more accessible and relevant to industry practitioners by converting research insights into practical tools and frameworks [24, 46]. For example, Kirchner et al. [67] created design cards combining prompts with research-based examples to guide designers' reflection in health informatics design. Similarly, Eva Hornecker [59] transformed a conceptual interaction framework with questions, theory, and imagery to support creative idea exploration in design workshops. Despite such efforts, the gap between research and practice continues to widen due to various translational barriers [24, 25, 93]. For instance, practitioners often view academic resources as irrelevant to real-world problems [88, 120], find them too abstract and difficult to understand and apply [3], and consider them overly complex [14, 24]. At the same time, researchers also express frustration over investing time and effort into research intended to support practice, which practitioners largely overlook [44]. These barriers partly stem from HCI research's lack of grounding in an understanding and acceptance of the nature of design practice, creating significant challenges in integrating HCI research into design practice [129].

Despite ongoing challenges, many HCI researchers continually reflect on and articulate design implications in their papers, aiming to facilitate the translation of research into design practice [143]. However, these recommendations are often fragmented and presented without a cohesive framework, which makes them difficult for practitioners to apply effectively. In the case of JME, design insights emerge from studies of different platforms, family configurations, and institutional settings [152], and are typically buried in discussion sections or embedded in system descriptions (e.g., [18]). As a result, designers who work on family-facing applications often have to rely on general heuristics or personal experience rather than on cumulative, research-based guidance about how to support JME. To address this gap, our study aims to consolidate research insights from different papers into systematic and practical design guidelines, complemented by application contexts, examples of technology features and potential tensions. By explicitly positioning our contribution as translational work, we respond to calls within HCI to move beyond isolated design implications and toward resources that acknowledge the realities of design practice, such as time constraints, competing stakeholder goals, and the need to navigate tensions rather than resolve them once and for all. In particular, our synthesis uses JME as the central lens to structure the resulting guidelines, which allows us to connect interactional qualities (for example, mutual engagement, dialogic inquiry, negotiation) with concrete design choices across media and settings. By synthesizing these guidelines, we hope to support researchers and practitioners in more effectively accessing and applying these translational insights in future JME design practices.

3 Methods

To identify and synthesize JME design guidelines in HCI, our qualitative process unfolded in two phases [33]: 1) preparation phase: conducting data collection using PRISMA procedures [99] to search parent-child JME papers in HCI, and 2) organizing and reporting phase: adopting a bottom-up approach with content analysis [70], we extracted and coded design guidelines from the selected papers, then analyzed and categorized these guidelines to develop a systematic and comprehensive taxonomy for a JME design guide. Grounded in Rogers's conception of "taxonomy" as a classification system that organizes items into categories based on their characteristics and roles [113], our taxonomy organizes the identified guidelines by their goals, namely the types of JME experiences they aim to create. Note that different papers employ different terms to describe design guidelines, including *"design principle"* (e.g., [132]), *"design implication"* (e.g., [149]), *"design suggestion"* (e.g., [2]), and *"design consideration"* (e.g., [102]). These terminologies were used similarly and interchangeably by different authors to describe guidelines for design practices. To minimize confusion caused by varying terminology, we use the term *"design guideline(s)"* throughout the remainder of this paper to encompass these different framings.

3.1 Preparation Phase: Searching Parent-Child JME Papers in HCI

To identify relevant literature, we conducted a structured search across two types of HCI publication sources: the ACM Digital Library (ACM DL) and HCI journals not archived in the ACM DL. Our goal was a qualitative synthesis of design guidelines rather than a registered, comprehensive literature review. ACM DL was chosen because most parent–child JME papers are published in ACM conferences, such as the ACM CHI, CSCW, and IDC conferences [152]. We also searched major HCI journals ($N = 29$), such as the *International Journal of Child-Computer Interaction* (Elsevier), *International Journal of Human-Computer Studies* (Elsevier), and *Human-Computer Interaction* (Taylor & Francis), which were selected by consulting the HCI Bibliography [103], Google Scholar's top publications on Human-Computer Interaction [87], and Scimago's journal rankings on Human-Computer Interaction [96]. A full list of journals we searched but that are not archived in the ACM DL can be found in the Appendix Table. Because our goal is to synthesize actionable design guidelines for interactive systems, we intentionally scoped our systematic search to HCI venues where authors routinely report technology-specific design implications and details of system use. Adjacent fields such as communication, developmental psychology, and education offer empirical characterizations of parent–child media use, but these studies rarely foreground implications for technology design or describe concrete systems in ways that can be directly translated into HCI practice, and therefore are not included for our search.

In the selected databases, we searched the keyword combination of [(*"parent*"* AND *"child*"*) OR (*"Famil*"* AND *"Joint Media Engagement"*)] in paper abstracts in December 2022. We conducted additional searches in June 2023 and December 2024 to include newly published papers since the initial search during the paper revision process. Because "joint media engagement" is a relatively new and unevenly adopted term in HCI, introduced in 2011 by Takeuchi and Stevens [132], we therefore also included demographic terms ("parent*" AND "child*") in the query and then manually

Table 1. The paper inclusion and exclusion criteria

Dimensions	Inclusion	Exclusion
Population	Parents: Including fathers and/or mothers in the JME, regardless of involving other family members	Only including non-parent family members (e.g., grandparents, older siblings), and no parents were included
	Children: Including young people between 0–18 years old in the JME	No children (0–18 years old) were included
Intervention	Parents and children co-engaged in the reported media experiences, in-person or remotely, regardless of the involvement of other family members like siblings	No media co-engagement between parents and children, e.g., solo engagement, sibling interactions, or only grandparent-child interactions
Outcomes	Empirical data: Clear, identifiable empirical accounts of parent-child interactions in the findings, i.e., readers can distinguish parent-child dyads	No empirical data about parent-child JME (e.g., argument papers, literature reviews), or interactions involving parent-child dyads cannot be identified [80]
	Include original design implications proposed by the paper	No new design implications generated
	Peer-reviewed full papers	Posters, workshop papers, work-in-progress papers, or papers not published in fully peer-reviewed venues
	Presented in English	Presented in other languages

screened for empirical accounts of parents and children engaging with media together, regardless of whether authors used the phrase JME or frameworks such as parental mediation or digital parenting. From the returned results ($N = 3,930$), we first loosely screened the papers' titles and abstracts to identify plausible papers around parent-child interactions, resulting in 312 papers. Then, we read the 312 papers to further examine if they satisfied our paper inclusion and exclusion criteria in Table 1, resulting in 113 papers sharing design guidelines for parent-child JME, primarily in their discussion sections. Compared to prior reviews on parent-child JME that identified 27 papers (i.e., [34]) and 89 papers (i.e., [152]), our corpus is substantially larger, which suggests that our broadened strategy helped us capture relevant work. Note that to safeguard the quality of the evidence base, we limited our corpus to full, peer-reviewed articles that provided sufficient methodological detail and reported empirical findings on parent–child JME. During screening, we excluded position papers, extended abstracts, and work that did not describe participants, procedures, or technologies in enough detail to support a design-oriented synthesis. Because our contribution is a qualitative synthesis rather than a quantitative meta-analysis, we did not apply a numerical quality scoring scheme or risk-of-bias checklist; instead, we treated these inclusion criteria and iterative author discussions during screening as our primary safeguards that the included papers offered a credible empirical basis for deriving design recommendations. Lastly, we manually added the research report by Takeuchi and Stevens that developed the concept of JME to our analysis as an additional source of design guidelines, given its foundational role in articulating JME and its extensive use in HCI as an analytic framework for productive parent–child media experiences, even though it is not a peer-reviewed publication and is not archived in an HCI venue [132]. Therefore, the total number of included articles for analysis is 114 (Figure 1).

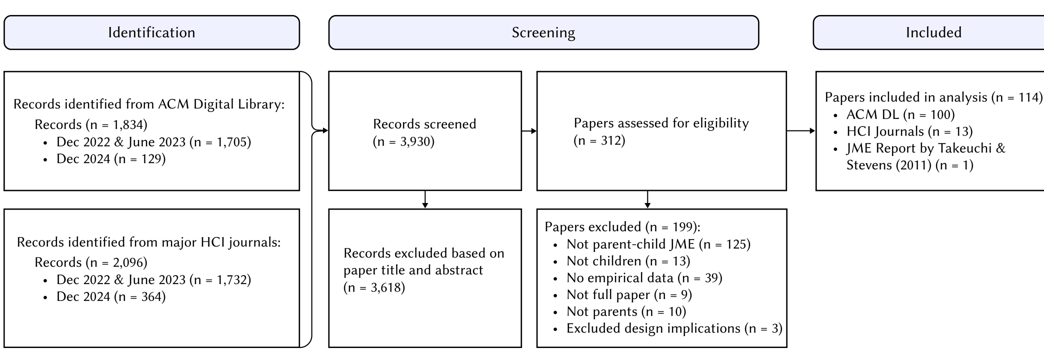

Fig. 1. The paper search and screening process

3.2 Organizing & Reporting Phase: Extracting and Analyzing Design Guidelines

To extract design guidelines for analysis, the first author (A1) reviewed all 114 papers, focusing especially on the discussion sections, as the papers typically present design guidelines as reflections derived from empirical JME findings. Using the qualitative analysis software MAXQDA, we identified and labeled relevant descriptions of design guidelines from each paper. The following vignette demonstrates an example of a design guideline from [150] about prioritizing physicality for JME media design:

> *"...We suggest* ***giving more priority to physicality in design.*** *Our examination of the relationship between parental mediation patterns and the three different types of coding kits shows that physical and hybrid kits can invite more participation from parents because the physical parts, like robots, can be easily noticed by other people in the house and elicit more interactions than a screen-based*

kit. Thus, to encourage more parental involvement like scaffolding and teaching, the design of coding kits and other creation-oriented media should consider including physical components." [150, p. 11, discussion]

We conducted *Content Analysis* [70] of the extracted guideline-relevant excerpts from included papers. Specifically, since many excerpts already articulated an intended design emphasis (e.g., *"giving more priority to physicality in design"* [150] and *"support for parents"* [77]), we began by identifying and synthesizing these themes in the extracted data, which was performed independently by two researchers to enable cross-checking. In parallel, we open-coded the concrete designer actions described in each excerpt (i.e., what a system should do, provide, or prompt), and used constant comparison to iteratively consolidate and refine codes. We then refined theme names and grouped themes with similar orientations into clusters, and translated each cluster into a candidate design guideline with an explicit scope and definition, iteratively revising wording to ensure each guideline captured a distinct design intent while minimizing overlap. The two authors collaboratively reviewed the evolving guideline set in regular meetings and resolved disagreements through discussion until consensus was reached, eventually yielding 14 design guidelines. Within each guideline, we then synthesized the recurring and distinct actionable tactics described across papers into associated design strategies, consolidating near-duplicates while preserving meaningfully different designer actions. To help designers and researchers better understand and apply this guideline structure, we further organized the 14 guidelines into four categories based on each guideline's design goal (i.e., the type of JME experience it aims to create): *individual-level engagement, co-engagement, inclusiveness and ethicality,* and *engagement outcomes*. Through this clustering process, four overarching JME design goals emerged: 1) *supporting sustained individual engagement,* 2) *supporting sustained co-engagement,* 3) *supporting inclusive and ethical engagement,* and 4) *promoting positive engagement outcomes,* which we employed to organize our findings. The resulting three-level taxonomy (four goals, 14 guidelines, and their associated strategies; summarized in Table 8 in the appendix section) constitutes our major research finding and contribution by systematically consolidating scattered guidance into a coherent structure. By organizing recommendations around shared goals and clarifying how high-level intents relate to actionable strategies, it reveals where prior work converges on similar recommendations, reduces redundancy, and supports more efficient application by designers and researchers [113].

To make the guideline set more targeted and actionable, we conducted a structured context-mapping analysis alongside our guideline and strategy synthesis. For each extracted guideline instance (i.e., the paper excerpt supporting a given guideline or strategy), we returned to the source paper and recorded a small set of contextual descriptors in a shared spreadsheet, focusing on factors most likely to shape how a strategy should be tailored in practice. First, we identified the technology platform described in each paper and summarized its key platform characteristics (e.g., device form and interaction setting). We then used an *inductive* clustering process to derive eight media-type groupings from these platform descriptions (e.g., learning media, wellbeing and behavior support media, communication media; see Table 2 for an overview). Second, we extracted the child age information reported in each study (target age range and/or participant ages), and linked it to the guideline instances supported by that study. Finally, we summarized these descriptors within each design guideline and its strategies (see Tables 3, 4, 5, 6 in the finding section and Table 8 in the appendix for the full set), allowing us to report recurrent contextual patterns grounded in the distribution of evidence across papers, thereby enabling readers to interpret where and for whom particular strategies were originated.

Lastly, it is important to note that our analysis centered on clustering conceptually aligned guidelines and assigning higher-level unifying names, a process jointly performed by all authors,

Table 2. Media types and explanations

Media type	Explanation
Learning media	Primary purpose includes learning or skill development, whether delivered through instruction, practice, or playful/gameful formats (including educational content delivery, learning games, playful learning apps, learning toolkits, conversational learning systems, and learning infrastructure).
Co-creative media	Primary purpose is creative production or socially connected creative play (the core activity is making, storytelling, co-creation, or creative play with others).
Wellbeing and behavior support media	Primary purpose is changing or supporting behavior, routines, affect, or wellbeing (for example, emotion regulation, physical activity, digital wellbeing rule compliance, disengagement support).
Tracking and assistive media	Primary purpose is ongoing tracking, monitoring, logging, or assistive capture to support care, reflection, or management over time.
Entertainment media	Primary purpose is leisure, amusement, or game-based entertainment (for example, recreational video games or entertainment-first apps).
Communication media	Primary purpose is family communication and relationship maintenance via mediated conversation (for example, video calling, messaging, and video-mediated communication).
Connected home and smart-device media	Primary purpose is supporting family interaction through networked, in-home devices and ambient computing systems (for example, smart speakers, voice assistants, connected toys, smart displays, and smart-home interfaces) that mediate routines, play, coordination, and household control.
Information-seeking media	Primary purpose is searching, browsing, or retrieving online information as part of a family activity (for example, web search).

who are experienced qualitative researchers. We also implemented several safeguards to support the quality and trustworthiness of this interpretative work. First, the two authors independently open-coded an initial subset of papers and then compared codes to develop a shared codebook with explicit definitions and inclusion criteria. The first author applied and iteratively refined the codebook across the remaining papers, while the second author periodically audited coded segments and flagged uncertainties for discussion. The team met regularly to revisit earlier decisions, challenge interpretations, and document analytic memos; this negotiated-agreement process was our primary mechanism for promoting consistency and reflexivity in the resulting themes and design guidelines, consistent with guidance for interpretive coding quality in CSCW and HCI [86]. Additionally, we did not perform a formal quality comparison of the extracted guidelines, because in our corpus none of the included studies directly evaluated or experimentally tested a design guideline as an intervention. The guidelines were almost always presented in the discussion or implications sections as authors' reflections on their empirical findings. Although the underlying studies used a range of qualitative and quantitative methods, these methods were not designed to compare the effectiveness of individual guidelines, and there is no shared metric across papers that would support ranking guidelines by quality of evidence. Instead, we retain the guidelines as articulated by the original authors and report the study contexts associated with each guideline to help readers assess their evidential grounding for their own purposes.

4 Findings: Design Guidelines for Parent-Child JME

The 114 included papers report studies conducted across 22 countries/regions (see Figure 2 in the appendix), with most situated in Western contexts and dominated by the USA ($N = 73$, 54.5%), followed by the UK ($N = 10$, 7.5%) and Canada ($N = 8$, 6.0%), while the remaining countries/regions were less represented. In the remainder of this section, we present the 14 design guidelines distilled from the included parent-child JME literature and organized around four high-level design goals: *sustaining individual engagement* (Section 4.1), *sustaining co-engagement* (Section 4.2), *supporting inclusive and ethical engagement* (Section 4.3), and *promoting positive engagement outcomes* (Section 4.4). Within each subsection, we introduce their guidelines in turn, clarify the design rationale behind each one, and synthesize concrete, actionable strategies that recur across prior systems and studies, highlighting representative examples where helpful. A full list of these design goals, guidelines, associated design strategies, and contexts can be found in Table 8 in the appendix.

4.1 JME Design Goal I: Supporting Sustained Individual Engagement

The first cluster of design guidelines (G1–G4) centers on supporting sustained individual engagement within parent-child JME by strengthening the child's ability and desire to participate meaningfully, even when a caregiver is not continuously co-present. Although JME is inherently relational, the literature repeatedly shows that children's moment to moment engagement is a prerequisite for co-engagement to emerge and persist, and that many JME activities unfold through fluid shifts between solo exploration and joint interaction. Accordingly, Section 4.1 focuses on design moves that help children get started confidently, stay oriented as they interact, and remain motivated to continue over time in ways that create more opportunities for later shared talk, coordination, and reflection. Table 3 provides an overview of G1–G4, including their descriptions, associated design strategies, and the contextual information from which each strategy originates (relevant child age and media type). We first describe how to reduce early friction and invite initial exploration (G1), then how to sustain intrinsic motivation through narrative meaning, personal relevance, and child self-expression (G2). Next, we address maintaining momentum by supporting smooth flow and recovery from confusion or breakdowns without undermining control (G3). Finally, we discuss sustaining engagement in everyday family life by helping children return smoothly after interruptions as interests and skills evolve (G4).

4.1.1 ***G1. Create Inviting Entry Points That Draw Children into Exploration***. Children may hesitate to start or may not know how to begin, so **G1** emphasizes reducing early friction and making first actions immediately inviting through action-oriented, sensory-responsive interactions. Across the dataset, this guideline emerged in diverse media contexts, including learning media (for example, hybrid paper-digital language toolkits and preschool learning games [43, 107], as well as remote co-reading platforms [110]), wellbeing and behavior support media (e.g., AR-augmented behavior coaching and parent-training support apps [49, 126]), communication media (for example, synchronous remote parent–child communication appliances [146]), tracking and assistive media that foreground system status and feedback [82], and co-creative media such as family makerspace activities [95]. The intended child age groups span early childhood through early adolescence, with substantial coverage of toddlers and preschoolers (for example, ages 1–6 and 3–6 in [49] and [43]), school-age children (for example, ages 3–11 and 5–10 in [16] and [37]), and some cases extending to early teens (e.g., ages 10–15 in [82], and 7–14 in [146]), indicating that "inviting entry" is a recurring design concern across both developmental stages and platform ecologies.

Within G1, papers converged on three complementary design strategies that help children begin quickly and feel drawn into exploration. *Welcoming contexts and setup for easy starts* focuses on configuring routines, physical setup, and input arrangements so that first use feels immediate rather than effortful; for instance, a preschool light-table learning system recommends arranging the light table, webcam, and projected display to support smooth transitions into activity [43], and other systems similarly emphasize setup choices that keep attention on interaction rather than device handling [126]. *Orientation cues and immediate feedback* then make "what to do next" visible through

Table 3. Design guidelines for **Supporting Sustained Individual Engagement** (G1–G4)

Guideline	Description	Identified Design Strategy	Child Age Group	Media Type
G1. Create inviting entry points that draw children into exploration	Children may hesitate to start or not know how to begin, so reduce entry friction and make first actions immediately inviting through action-oriented, sensory-responsive interactions.	***Welcoming contexts and setup for easy starts:*** Configure routines, physical setup, and input arrangements so children can begin comfortably with minimal friction.	2-3 [126]; 2-5 [110]; 3-6 [43]; 3-7 [107]; 6-12 [100]; 7-14 [146]	Learning media [43, 107, 110]; Communication media [146]; Wellbeing and behavior support media [100, 126]
		Orientation cues and immediate feedback: Use clear prompts and engaging audiovisual feedback so children quickly understand what actions are possible and what to do next.	1–6 [49]; 3–5/6 [35]; 3–6 [43]; 3–11 [16]; 5–10 [37]; 5–15 [41]; 6–12 [27]; 7-10 [95]; 10–15 [82]	Wellbeing and behavior support media [49]; Learning media [35, 37, 41, 43]; Tracking and assistive media [82]; Communication media [16, 27]; Co-creative media [95]
		Hands-on exploratory entry through manipulables and tinkering: Center early tasks on manipulable materials and low-stakes creative iteration so children can touch, move, play, and experiment as a natural way to explore rather than aiming for a polished outcome.	2–11 [134]; 3-7 [107]; 3–9 [150]; 4–7 [75]; 5–10 [114]; 7-10 [95]	Wellbeing and behavior support media [75, 134]; Co-creative media [95]; Learning media [107, 114, 150]
G2. Sustain motivation through personally meaningful experiences	Motivation fades when experiences feel generic or imposed, so ground engagement in purpose, lived-context relevance, and self-expression that helps children feel "this is for me."	***Narrative meaning through characters and goals:*** Use story contexts and roles to provide purpose and emotional tone independent of individual tailoring.	3-5 [125, 137]; 3–6 [133]; 3–8 [26]; 4–7 [75]; 4–17 [40]; 6–13 [131]	Wellbeing and behavior support media [75, 125, 131, 137]; Connected home and smart-device media [26, 40]; Learning media [133]
		Personal relevance through system tailoring: Tailor themes, pacing, and interaction pathways to children's lived contexts and interests.	2–5 [110]; 3–8 [116]; 3–9 [149]; 4-6 [74]; 4–7 [75]; 4–17 [38]; 5–9 [78]; 6–12 [61]	Learning media [74, 110, 149]; Communication media [61]; Wellbeing and behavior support media [75, 78, 116]; Connected home and smart-device media [38]
		Child-authored meaning through self-representation and reflection: Let children create and revisit artifacts that express who they are and reinforce "this is for me."	4–7 [75]; 7–10 [95]; 5–10 [114, 153]; 8–15 [121]; 7–13 [62]; 6–12 [61]	Wellbeing and behavior support media [75]; Co-creative media [95]; Learning media [114, 153]; Tracking and assistive media [121]; Entertainment media [62]; Communication media [61]
G3. Maintain interaction flow with momentum and recoverability	Confusion and breakdowns can stall interaction, so design flow that keeps children oriented, supports recovery from errors, and preserves a sense of control.	***Flow cues and progress reassurance:*** Keep children oriented to what is happening and what comes next with clear progress cues, supportive responses, and normalized retries that sustain momentum.	1.5–9 [17]; 2–3 [126]; 3–5 [20]; 3–8 [26]; 4–7 [22, 144]	Learning media [17, 20, 22, 144]; Wellbeing and behavior support media [126]; Connected home and smart-device media [26]
		Breakdown-aware repair pathways: Anticipate misunderstandings and provide child-friendly ways to diagnose, undo, and continue after confusion or failure.	3–5 [20]; 0–16 [11]; 0–17 [12]	Learning media [20]; Connected home and smart-device media [11, 12]
		Autonomy and boundary-respecting control: Give meaningful control over choices, rules, and sharing, including ways to pause, adjust, or exit intrusive system behavior.	3–6 [54]; 3–13 [151]; 4–17 [38]; 6–13 [131]; 8–12 [66]; 9–14 [128]	Learning media [66, 151]; Wellbeing and behavior support media [54, 131]; Connected home and smart-device media [38]; Tracking and assistive media [128]
G4. Support sustainable re-engagement over time	Interruptions make returning hard, so support re-entry with feasible routines, preserved progress, and return-friendly structure that still works when the child comes back alone.	***Everyday fit through flexible configuration:*** Support portability across contexts and let families tune scope, timing, and effort so returning remains feasible within real schedules and constraints.	0–10 [130]; 3–5 [71, 132]; 3–8 [156]; 4–7 [119]; 7–10 [147]; 9–14 [128]	Tracking and assistive media [128]; Learning media [71, 119, 130, 132, 156]; Communication media [147]; Entertainment media [119]
		Re-entry continuity through saved state and modular progression: Preserve progress and provide recaps and return-friendly modules so children can resume smoothly after gaps while progression adapts to skill growth.	3–8 [26]; 6–12 [18]; 10–12 [15]	Learning media [15]; Tracking and assistive media [18]; Connected home and smart-device media [26]
		External supports that sustain participation when appropriate: Provide peer or community structures that help engagement persist beyond individual motivation.	3–8 [116]; 4–17 [38]; 10–15 [82]	Wellbeing and behavior support media [116]; Connected home and smart-device media [38]; Tracking and assistive media [82]

clear prompts and salient audiovisual responses. An AR-augmented puppet system, for example, uses expressive sounds and movements to attract attention while supporting timely adult responses via prepared feedback options [49]. Additionally, *hands-on exploratory entry through manipulables and tinkering* invites engagement by centering early tasks on tangible materials and low-stakes iteration, as seen in family makerspace workshops that encourage playful experimentation and iterative making over polished outcomes [95].

Across these strategies, the dataset also reveals recurring trade-offs that designers may need to actively balance. Reducing friction at the start often shifts work upstream into environmental orchestration and caregiver preparation [126], and in some contexts may drift toward overly directive adult involvement that can dampen older children's willingness to initiate if it feels controlling [100]. Similarly, highly salient feedback requires calibration to everyday conditions and expectations: sound cues may become unreliable or ambiguous in noisy settings [43], interaction moves may not match children's intuitions [16], and remote scenarios may require additional viewing and awareness controls [35]. Finally, while open-ended tinkering can spark curiosity and sustain entry through play [114], it benefits from lightweight structure and feasible material setups so exploration remains easy to start rather than slowed by practical constraints [150].

Overall, G1 highlights that designing for entry is less about any single onboarding feature than about calibrating how much preparation, guidance, and structure is provided at the outset. When these elements are tuned to children's expectations and the realities of everyday family routines, early interactions can feel immediately actionable and rewarding, creating a stable launch point for deeper exploration and sustained engagement over time.

4.1.2 ***G2. Sustain Motivation Through Personally Meaningful Experiences***. Motivation often fades when activities feel generic, externally imposed, or disconnected from children's everyday lives, so **G2** emphasizes sustaining engagement by grounding experiences in purpose, lived-context relevance, and opportunities for self-expression that help children feel "this is for me." Across the dataset, this guideline appeared across a broad set of media contexts, including wellbeing and behavior support media (for example, story-framed training and family support experiences [75, 125, 137]), connected home and smart-device media (e.g., in-home smart speakers and voice-agent experiences designed as familiar partners [26, 40]), learning media (for example, culturally grounded literacy experiences and home learning toolkits [133, 149]), communication media (for example, customizable video-mediated systems for remote family play [61]), and co-creative and reflective systems where meaning is built through making and revisiting artifacts (e.g., makerspace workshops and creative computing activities [95, 153]). Intended child age groups span early childhood through adolescence (roughly ages 2 to 17), with substantial concentration in preschool and school-age ranges where sustained motivation is a recurring concern for repeated family use [125, 137, 149], alongside cases that extend into early teens when engagement hinges on autonomy and personally resonant content [62, 121].

Across the G2 corpus, three complementary design strategies emerged that sustain motivation by strengthening purpose, relevance, and ownership over time. *Narrative meaning through characters and goals* uses story contexts, roles, and unfolding goals to give activities a shared sense of direction and emotional tone even without heavy personalization. For instance, smart-speaker and voice-agent systems position a trusted character-like partner as a familiar, engaging presence that helps carry interaction forward across repeated sessions [40], and narrative framing similarly anchors participation in story-driven learning and family contexts [131, 133]. *Personal relevance through system tailoring* then adapts themes, pacing, and interaction pathways to children's interests and family routines so engagement feels situated rather than one-size-fits-all. For example, some systems enable customizable play scenes that foster creativity and communication [61], while others adjust content, functionality, and difficulty to fit different children and contexts [38, 78]. Finally, *child-authored meaning through self-representation and reflection* sustains engagement by letting children create and revisit artifacts that express who they are, turning participation into an accumulating record of their ideas and identity. AI-infused multimaterial storymaking, for instance, supports children and families in constructing personal symbols and expressive artifacts as part of the experience [75], echoed in family makerspace and creative computing contexts where children author projects and iteratively refine them over time [95, 153].

Even as these strategies support sustained motivation, evidence reveals design tensions that call for careful calibration. For instance, narrative framing can make activities feel purposeful, yet designers should balance how tightly the story constrains interaction so families can appropriate, reinterpret, or culturally ground meaning without the narrative feeling restrictive or mismatched to what resonates at home [133, 137]. Similarly, tailoring can deepen relevance and ownership, but it may introduce setup and configuration work and foreground system decisions in ways some families find uncomfortable, particularly when agent-like behavior becomes salient [38, 149]. Finally, child-authored creation strengthens ownership, though open-ended expressive work benefits from lightweight structure so children are not stalled by too many choices or by practical constraints in materials, time, and coordination during family use [75, 95].

In sum, G2 indicates that sustaining motivation depends on how systems support continuity of meaning across encounters. Narrative framing, adaptable tailoring, and child-authored representations jointly provide mechanisms for families to re-enter, reinterpret, and extend experiences in ways that remain personally compelling.

4.1.3 ***G3. Maintain Interaction Flow With Momentum and Recoverability***. Confusion, errors, and interaction breakdowns can quickly stall children's engagement, so **G3** focuses on designing for momentum: keeping children oriented to what is happening, helping them recover smoothly when things go wrong, and preserving a sense of control while they continue. The evidence for G3 spans multiple media contexts, particularly learning media (e.g., tablet-based voice-driven educational games and interactive e-books with haptic feedback [20, 22], as well as broader home and distance learning ecosystems [151]), connected home and smart-device media (e.g., smart speakers and teleoperated voice-agent family play systems [12, 26]), wellbeing and behavior support media (e.g., parent-training support apps and tools that scaffold intentional screen use [54, 126]), and tracking and assistive media (e.g., assistive reading technologies and situated self-tracking systems [17, 128]). Intended child age groups range from toddlers and preschoolers (e.g., 2–3 and 3–5 [20, 126]) through school-age children (e.g., 1.5–9 and 8–12 [17, 66]) and into early adolescence (e.g., 9–14 [128]), with some systems framed at the family level where breakdown and repair can involve both children and caregivers (e.g., 0–17 [12]). In this dataset, G3 most often appears in settings marked by everyday variability, where usability is continually tested by imperfect sensing, noisy environments, shifting attention, and mixed caregiver involvement.

Papers operationalized G3 through three interlocking design strategies that support forward motion without requiring flawless interaction. *Flow cues and progress reassurance* keep children oriented to what just happened and what comes next through clear progress cues, supportive responses, and normalized retries that sustain momentum. In a tablet-based voice-driven educational game, for example, the system provides encouraging feedback and retry prompts so children continue turn-taking even after repeated failures [20], and related work similarly emphasizes real-time, affirming feedback that treats mistakes as part of the activity rather than as endpoints [144]. *Breakdown-aware repair pathways* then anticipates misunderstanding and provide child-friendly ways to diagnose, undo, and continue after confusion or failure. Studies of digital home assistants describe how families shoulder substantial repair work and argue for assistants that collaborate in breakdown handling through explicit clarifications and discourse scaffolding that guides users toward effective repair moves [12], rather than leaving families to repeatedly guess what the system heard. Finally, *autonomy and boundary-respecting control* preserves a sense of agency by giving meaningful control over rules, pacing, and participation, such as ways to pause, adjust, or exit intrusive system behavior. For instance, screen-time mediation tools emphasize negotiation-oriented controls that acknowledge rationales and perspectives so that boundaries can be adjusted without derailing interaction [66], and other systems similarly surface norms or plans while allowing flexibility to deviate through informational, non-coercive feedback [54].

Putting these strategies into practice, however, requires navigating certain design tensions. First, strong progress cues and multi-sensory feedback can sustain momentum, yet they should be tuned so they do not distract from the activity's core meaning or add unnecessary load (e.g., minimizing haptic feedback that is not directly tied to shared sense-making [22], and reducing motor or cognitive burden for caregivers who operate systems while keeping interaction child-centered [26]). Second, repair scaffolds can reduce frustration, but overly directive prompting risks turning breakdown recovery into a compliance task rather than a child-led continuation, especially in voice settings where imperfect recognition is common [12, 20]. Likewise, control features can protect agency, though they often sit at the fault line between smooth flow and boundary-setting: designs need to balance teen autonomy with parental oversight, and enable "non-use" or stopping points without escalating conflict or making the system feel controlling [38, 66].

Overall, G3 points to resilience as a primary quality of engaging interaction, where orientation cues, repair support, and adjustable control work together to keep families moving through breakdowns while maintaining children's sense of agency and willingness to persist.

4.1.4 ***G4. Support Sustainable Re-Engagement Over Time***. Everyday interruptions, shifting routines, and uneven availability often make it hard for children to return to an activity, so **G4** focuses on sustaining engagement across time by making re-entry feasible, preserving continuity, and supporting return-friendly structures that still work when a child comes back alone. In the dataset, this guideline appeared across learning media (e.g., electronic storybooks and preschool literacy supplements [71, 132]), tracking and assistive media (e.g., a tangible self-tracking system with a companion app and a child-parent health tracking workflow [18, 128]), communication media (e.g., a remote synchronous parent-child media space [147]), connected home and smart-device media (e.g., smart-speaker routines that scaffold after-school activities [38]), wellbeing and behavior support media (e.g., a family physical activity app that adapts support to participation barriers [116]), and entertainment-adjacent portable device use that extends learning and play across contexts (e.g., tablets and smartphones used while traveling [119]). The intended age range spans early childhood through mid-adolescence (approximately 0–17), with prominent coverage in preschool and school-age use where interruptions and re-entry are frequent (e.g., 3–5 [71] and 3–8 [156]), alongside cases extending into early teens where sustained return depends on autonomy and feasible routines (e.g., 9–14 [128] and 10–15 [82]). Across papers, G4 is especially visible in designs that anticipate sporadic use and seek to make "coming back" a normal part of interaction rather than a failure state.

Rather than treating engagement as continuous, papers approached G4 through three design strategies that make returning both practical and motivating after gaps. The first, *everyday fit through flexible configuration*, supports portability across contexts and lets families tune scope, timing, and effort so returning remains realistic within schedules and constraints. For example, work on home technologies for children with ADHD advocates for situated artifacts that are modular and portable, enabling use across different environments where context strongly shapes behavior [128], and related evidence emphasizes that family activities such as co-reading often occur incidentally and on-the-go rather than only in idealized, dedicated settings [130]. The second strategy, *re-entry continuity through saved state and modular progression*, preserves progress and provides return-friendly structure so children can resume smoothly while support adapts to growing competence. In a collaborative child-parent health tracking system, families gradually developed more independent routines, suggesting value in designs that shift from parent-led scaffolding toward child-facing reminders and then taper guidance as skills develop [18]. Finally, *external supports that sustain participation when appropriate* extend re-engagement beyond individual motivation by drawing on social, community, or mediated supports that help participation persist during difficult periods. For instance, a family physical activity intervention characterizes participation barriers by their frequency and proposes that systems respond with coping strategies such as temporary pauses, longer breaks when disruptions are acute, and links to local community resources when sustained engagement is hard to maintain [116].

Translating these strategies into systems may introduce recurring design tensions. Greater configurability and portability can broaden the situations in which families are able to return, yet it can also raise questions about how much choice is manageable, with some work explicitly calling for multiple levels of configuration granularity to match varied parent preferences [156]. Continuity mechanisms such as saving options, tailoring progression, or maintaining history can smooth re-entry, but they often shift effort onto adults unless designs keep capture and updating lightweight, as illustrated by concerns that preparing reusable content outside sessions may be more feasible for professionals than for busy parents [26]. Finally, external supports and planned pauses can protect long-term participation, though they require careful calibration so that stepping away does not become disengagement and so that added supports fit the family's capacity and coordination realities [38, 116].

In short, G4 positions sustainable re-engagement as a temporal design problem: systems can better support sustained individual engagement when they make returning easy to fit into everyday life, preserve enough continuity to resume without re-learning, and selectively offer outside supports that keep participation viable across disruptions.

4.2 JME Design Goal II: Supporting Sustained Co-engagement

The second cluster of design guidelines (G5–G8) shifts from sustaining children's individual engagement (Section 4.1) to sustaining co-engagement by addressing what it takes for families to keep participating together over time, even as attention, roles, and circumstances change. Table 4 provides an overview of G5–G8. These guidelines address the interactional work that sustains joint media engagement: coordinating roles and shared agency to avoid adult- or system-dominated participation (G5), scaffolding collaboration and conversation so families align understanding as they act (G6), enabling parallel participation through co-use infrastructures that reduce bottlenecks (G7), and supporting reconnection across distance or routine disruptions with shared artifacts, timing cues, and lightweight ways to resume being together (G8).

Table 4. Design guidelines for **Supporting Sustained Co-Engagement** (G5–G8)

Guideline	Description	Identified Design Strategy	Child Age Group	Media Type
G5. Coordinate roles, shared agency, and system autonomy in joint engagement	Joint engagement can become unbalanced or adult- or system-dominated, so clarify roles, support negotiation, and make system initiative adjustable so shared agency stays child-respecting.	***Balanced participation in cooperative play:*** Distribute influence and contribution opportunities so co-engagement feels reciprocal.	0–10 [130]; 2–4 [48]; 3–8 [156]; 3–17 [155]; 4–6 [53]; 7–10 [95]; 9–11 [115]; 9–12 [127]; 11–14 [7]; 13–17 [47]	Entertainment media [7, 53]; Wellbeing and behavior support media [47, 115, 127]; Co-creative media [95, 155]; Learning media [48, 130, 156]
		Negotiation supports for rules, turns, and decisions: Provide mechanisms to resolve disputes and make joint decisions constructively.	2–10 [102]; 4–5 [13]; 5–10 [153, 154]; 6–12 [18]; 7–13 [62]; 7–14 [146]; 8–12 [66]; 10–14 [140]; 10–14 [10]; 13–18 [39, 97]	Co-creative media [13, 102]; Connected home and smart-device media [97]; Learning media [10, 66, 140, 153]; Communication media [146, 154]; Tracking and assistive media [18]; Entertainment media [62]; Wellbeing and behavior support media [39]
		Caregiver mediation without taking over: Offer parent supports that help adults participate while preserving child ownership.	0–15 [98]; 1–9 [132]; 2–10 [102]; 2–11 [134]; 2–13 [64]; 3–5 [125, 141]; 3–6 [133, 145]; 3–9 [150]; 4–10 [58]; 5–12 [5]; 6–12 [18]; 7–14 [112]; 7–10 [95]	Wellbeing and behavior support media [125, 134]; Learning media [5, 58, 98, 112, 132, 133, 145, 150]; Co-creative media [64, 95, 102]; Entertainment media [141]; Tracking and assistive media [18]
		Adjustable agent roles and initiative: Make system autonomy understandable and configurable (for example, turn-taking, coach vs peer role, waiting for invitation).	1–6 [49, 132]; 1.5–9 [17]; 3–5 [56]; 3–8 [26, 156]; 4–5 [57]; 4–6 [28]; 4–17 [40]; 8–12 [50]; 8–15 [122]	Connected home and smart-device media [26, 40]; Learning media [17, 28, 50, 56, 57, 132, 156]; Wellbeing and behavior support media [49, 122]
G6. Scaffold collaboration and conversation in the moment	Co-engagement can falter when families lack structures for talk and coordination, so provide interactional scaffolds that prompt dialogue and help participants align actions during shared use.	***Conversation scaffolds for talk moves:*** Use prompts and cues that elicit caregiver-child dialogue during play and sensemaking.	1–6 [132]; 1–9 [132]; 3–5 [132]; 2–13 [64]; 3–6 [145]; 3–8 [26, 116, 156]; 4–7 [22, 75, 144]; 4–17 [40]; 5–9 [123]; 5–10 [158]; 5–12 [89]; 6–11 [117]; 6–12 [18]; 7–10 [95]; 7–12 [97]; 8–12 [66]; 9–11 [115]; 10–12 [9]; 10–14 [76]; 10–15 [42]	Co-creative media [64, 95]; Connected home and smart-device media [26, 40]; Tracking and assistive media [18, 97, 117]; Entertainment media [89]; Learning media [9, 22, 66, 76, 123, 132, 144, 145, 156, 158]; Wellbeing and behavior support media [75, 115, 116]; Communication media [42]
		Joint action structures for shared doing: Provide tasks, turn formats, and role routines that make doing together feasible and balanced.	1–9 [132]; 2–13 [64]; 3–8 [118]; 3–9 [149]; 4–5 [13]; 4–17 [40]; 6–12 [61]; 7–12 [97]	Co-creative media [13, 64]; Tracking and assistive media [97]; Wellbeing and behavior support media [118]; Communication media [61]; Learning media [132, 149]; Connected home and smart-device media [40]
		Coordination cues for role shifts and breakdowns: Provide lightweight guidance for handoffs, role changes, and moments of confusion so collaboration continues.	1–9 [132]; 3–5 [56]; 4–5 [57]; 7–9 [108]	Learning media [56, 57, 108, 132]
G7. Enable parallel participation through co-use infrastructure	When family members move at different paces or take different roles, single-user interaction creates bottlenecks, so provide co-use infrastructure that enables parallel participation with low coordination overhead.	***Shared state and role-aware coordination cues:*** Make the joint activity legible (where you are, what changed, who did what, and what to do next) so participants stay aligned without one person narrating.	0–17 [29]; 0–10 [130]; 1–10 [2]; 2–5 [110]; 3–5 [35]; 3–17 [155]; 5–10 [154]; 6–12 [27]; 6–11 [117]; 7–9 [108]; 10–14 [136]; 10–17 [106]	Learning media [35, 108, 110, 130, 136]; Information-seeking media [106]; Communication media [2, 27, 154]; Entertainment media [29]; Tracking and assistive media [117]; Co-creative media [155]
		Multi-user input and parallel action: Support simultaneous contribution (for example, role-split inputs, multi-touch, parallel manipulation).	0–17 [12, 29]; 2–35 [89]; 3–17 [155]; 4–6 [53]; 5–10 [36, 154]; 6–12 [27]; 8–15 [121]; 10–14 [76, 136]	Entertainment media [29, 53, 89]; Connected home and smart-device media [12]; Learning media [36, 76, 136]; Co-creative media [155]; Tracking and assistive media [121]; Communication media [27, 154]
		Lightweight handoffs and interruptible resumption: Make pauses, role switches, and resumption quick so co-engagement survives everyday disruptions.	1–9 [132]; 3–8 [156]; 4–6 [53]; 4–17 [83]; 6–12 [27]; 10–12 [79]; 10–14 [76]	Entertainment media [53, 83]; Learning media [76, 79, 132, 156]; Communication media [27]
G8. Sustain co-engagement across time, distance, and family routines	Distance, schedules, and shifting participation fragment shared moments, so support reconnection and shared history that helps families resume "being together" across time and distance.	***Remote and asynchronous co-engagement:*** Enable participation when family members are apart while preserving social connection.	1–10 [2]; 2–5 [110]; 3–8 [156]; 3–9 [150]; 3–11 [16]; 4–17 [83]; 6–12 [61]; 7–14 [146]; 7–10 [147]; 8–12 [66]; 10–15 [42]; 14–18 [69]	Learning media [66, 110, 150, 156]; Wellbeing and behavior support media [69]; Communication media [2, 16, 42, 61, 146, 147]; Entertainment media [83]
		Reconnection supports through shared artifacts and timing cues: Persist and resurface joint creations, histories, or moments and reduce initiation overhead with scheduling, reminders, rendezvous supports, and prompts to rejoin, so families can reconnect and continue.	1–9 [132]; 1–10 [2]; 2–5 [110]; 4–5 [13]; 4–7 [75]; 4–17 [83]; 5–9 [123]	Co-creative media [13]; Entertainment media [83]; Communication media [2]; Learning media [110, 123, 132]; Wellbeing and behavior support media [75]
		Rituals, bonding, and mutual recognition: Design for shared enjoyment and acknowledgment aligned with everyday routines and transitions.	0–11 [84]; 3–6 [148]; 3–5 [35]; 3–8 [116]; 4–5 [13]	Co-creative media [13]; Learning media [35, 148]; Wellbeing and behavior support media [84, 116]

4.2.1 *G5. Coordinate Roles, Shared Agency, and System Autonomy in Joint Engagement*.

JME can drift into an imbalanced dynamic where participation becomes adult-dominated, child-dominated, or subtly steered by the system. **G5** focuses on coordinating roles and shared agency so families can participate reciprocally, negotiate decisions as they arise, and understand and adjust what the system is doing. In the dataset, G5 is grounded in diverse media contexts, including entertainment media (e.g., co-located parent-child play with tablet apps and cooperative console games [7, 53], co-creative media (e.g., family makerspace and fabrication activities [95, 155]), learning media (e.g., home learning kits and parent-child reading companions [56, 150]), connected home and smart-device media (e.g., household smart technologies that shape family routines and coordination [97]), and wellbeing and behavior support media (e.g., parent-child support and self-regulation systems [115, 122]). The intended child age groups span early childhood through late adolescence (approximately 0–18), with substantial coverage of preschool and school-age children as well as multiple cases centered on early teens where role negotiation and autonomy are salient (e.g., [7, 13, 47, 97]). Across these settings, G5 appears most clearly when a system mediates turn-taking, attention, or authority, and where sustaining co-engagement depends on keeping roles legible and agency shareable rather than assumed.

Across papers, G5 was enacted through four complementary strategies that align who leads, who follows, and how the system participates. The first, *balanced participation in cooperative play*, distributes influence and contribution opportunities so co-engagement feels reciprocal rather than one-sided. For example, studies of parent-child cooperative play and games emphasize designs that support shared goals and contributions from both partners instead of positioning one person as the primary actor [7, 53], while tangible supports in collaborative making similarly foreground mutual involvement by shaping how each partner can act and respond [115]. The second, *negotiation supports for rules, turns, and decisions*, provides mechanisms to resolve disputes and make joint choices constructively in the moment. Tablet-based co-creative activities, for instance, highlight the value of structuring turn-taking and shared planning so parents and children can coordinate decisions during joint creation [13], and learning-oriented JME work argues for designs that do not simply suppress disagreement but give children and caregivers workable interactional resources to advocate, align, and continue [153]. The third, *caregiver mediation without taking over*, offers supports that help adults participate while preserving child ownership, such as prompts, role guidance, or scaffolded participation that keeps the child's contributions central. Evidence from public and home settings shows how adult actions can either sustain a child's sense of ownership through supportive questioning and shared attention or inadvertently decenter the child through physical control and off-task steering [98], motivating designs that help adults stay supportive without becoming the main operator [95, 150]. Finally, *adjustable agent roles and initiative* treats system autonomy as a design variable: systems make their role understandable and configurable (e.g., waiting for invitation versus taking initiative, coach versus peer) so families can tune how directive or quiet the agent should be. Work on educational robots and home agents emphasizes timing and context sensitivity, such as avoiding interruptions and giving families leverage over when and how the system engages [56, 57], while other studies note that families differ in how much system involvement they want, suggesting the value of adjustable initiative rather than a single best autonomy setting [26, 122].

Implementing these strategies also raises important balancing considerations. Distributing contribution opportunities can support reciprocity, yet real families often bring asymmetric expertise, confidence, or motivation, creating tension between equal participation and role specialization that still feels respectful [7, 47]. Adding negotiation supports can help coordination, but it can also introduce interaction overhead or over-structure joint activity, especially when families benefit from keeping play or creation fluid rather than procedural [13, 153]. Likewise, caregiver-facing scaffolds can reduce breakdowns and help adults contribute, while still risking takeover if guidance pushes parents toward directing content, controlling devices, or narrowing children's agency [95, 98]. System autonomy sits at a similar fault line: proactive initiative can be supportive, but it can also become disruptive or authoritative if it interrupts at the wrong time or becomes too hard to interpret and regulate [56, 57, 122].

Together, G5 frames sustained co-engagement as an agency coordination problem, where durable "being together" relies on designs that distribute participation, support in-the-moment negotiation, scaffold adult involvement without displacement, and make system initiative visible and tunable within the family's preferred interaction style.

4.2.2 ***G6. Scaffold Collaboration and Conversation in the Moment*** . Co-engagement can unravel when families do not have lightweight structures for talking, coordinating attention, and aligning actions as interaction unfolds. **G6** addresses this problem by positioning systems as interactional supports that help participants generate productive talk, stay coordinated while doing, and recover when collaboration wobbles in the moment. Across the dataset, G6 is instantiated in varied media contexts, with strong representation in learning media (e.g., library-based family science making programs that embed discussion prompts [158], museum-oriented tangible learning experiences [9], and in-home educational social robots that scaffold parent-child talk [57]), alongside co-creative media (e.g., intergenerational makerspace workshops for designing and fabricating games [64]), connected home and smart-device media (e.g., smart speakers framed as supporting family conversation routines [40]), communication media (e.g., tangible photo artifacts for parent-teen communication [42]), and wellbeing and behavior support media (e.g., collaborative family exergames that structure shared participation [118]). The intended child age groups span early childhood through adolescence (approximately ages 3–17), with substantial coverage in preschool and school-age settings where co-use talk is central to learning and coordination (e.g., ages 3–6 [145] and 7–9 [108]), as well as cases that explicitly include teens and emphasize family communication dynamics (e.g., ages 10–15 [42] and 4–17 [40]). In this evidence base, G6 most often appears when designers treat moment-to-moment interaction as a site of work, where co-engagement depends on timely supports for dialogue and coordination rather than assuming conversation will naturally emerge.

The literature operationalizes G6 through three interconnected strategies that work together to keep collaboration moving as families interact. *Conversation scaffolds for talk moves* uses prompts and cues to elicit caregiver-child dialogue during play and sensemaking, making it easier to ask questions, explain reasoning, and sustain back-and-forth talk without requiring caregivers to invent scaffolding on the fly. For example, a family science making intervention in libraries integrates discussion prompts into activity flow, using facilitator-delivered prompts to bring explanatory talk into informal routines rather than leaving conversation to chance [158]. *Joint action structures for shared doing* then provides tasks, turn formats, and role routines that make doing together feasible and balanced, so families can coordinate contributions while still sharing ownership of the activity. Evidence from collaborative family exergames highlights how structured shared formats, such as game mechanics that intentionally spur social interaction, can create repeated opportunities for families to coordinate and converse during co-play [118]. Finally, *coordination cues for role shifts and breakdowns* offers lightweight guidance for handoffs, role changes, and moments of confusion, so collaboration remains resilient when attention drifts or when one partner becomes stuck. For example, in parent-child computational play and in-home educational robotics, systems are framed as supporting coordination by providing representational or interactional supports that help families translate between perspectives, notice what to do next, and re-align when breakdowns occur [57, 108].

Translating these strategies into designs involves considering balances that shape whether scaffolding feels supportive or intrusive in the moment. While prompts can successfully elicit task-focused dialogue, the evidence suggests that prompting alone does not guarantee the intended depth or form of conversation: in some settings, planned discussion patterns did not materialize as expected [64], and in others, reflective features still yielded limited relationship-oriented talk [42]. Relatedly, adding structure through prescribed roles, turn formats, or mechanics can reduce coordination burden, but it also changes the interactional texture of co-use, sometimes making collaboration feel procedural or shifting attention toward performance and competition rather than shared exploration [118]. A similar calibration challenge appears in coordination cues and breakdown supports. Proactive guidance can help families re-align when attention drifts or confusion arises, yet frequent or overly directive interventions can interrupt conversational flow and dampen children's sense of initiative, particularly in systems that adopt an active agent role [56, 57].

In sum, G6 suggests that sustained co-engagement is better supported when talk scaffolds, shared-doing structures, and repair cues are treated as adjustable interactional resources, offering enough guidance to keep families aligned while preserving conversational rhythm, improvisation, and shared ownership in the moment.

4.2.3 ***G7. Enable Parallel Participation Through Co-Use Infrastructure***. When family members move at different paces or take different roles, single-user interaction can become a bottleneck that forces one person to drive while others wait, watch, or narrate. **G7** addresses this coordination problem by designing co-use infrastructure that enables parallel participation with low coordination overhead, so shared activity can continue even when contributions are simultaneous, asynchronous, or role-differentiated. The dataset situates this guideline across a wide range of media contexts, including learning media (e.g., parent-child computational play and collaborative learning tools [35, 108]), information-seeking media (e.g., collaborative online search and family information problem solving on everyday devices [106]), communication media (e.g., family video chat and remote intergenerational play platforms [2, 154]), entertainment media (e.g., co-located console games with motion sensing that coordinate multiple participants [29]), tracking and assistive media (e.g., family tracking dashboards that support shared monitoring and interpretation [117]), and co-creative media (e.g., collaborative creative drawing and making contexts [155]). Intended child age groups span infancy through adolescence (approximately 0–17), with substantial coverage in school-age ranges where joint activity often involves simultaneous contribution (e.g., 6–12 in [27, 117]), alongside many cases that include broad family participation or teens (e.g., 0–17 [29] and 10–14 [136]). In this evidence base, G7 appears most strongly in systems where being together depends less on turn-taking and more on enabling multiple, overlapping forms of participation.

Across papers, G7 was operationalized through three complementary strategies that reduce bottlenecks by making joint action legible, allowing simultaneous input, and keeping collaboration resilient to interruptions. *Shared state and role-aware coordination cues* make the joint activity visible (e.g., where you are, what changed, who did what, and what to do next) so participants can stay aligned without one person narrating. For instance, intergenerational family search designs emphasize shared information interfaces that externalize query state and evolving findings, supporting families in coordinating contributions as they jointly explore information rather than relying on a single operator to relay progress [106]. *Multi-user input and parallel action* then supports simultaneous contribution through role-split inputs, multi-touch, or parallel manipulation, enabling family members to act at the same time without waiting for control to be handed over.

Co-located parent-child play on tablets illustrates this approach by explicitly designing multi-touch scenarios where adult and child can interact concurrently while remaining interrelated within a shared play space [53]. Finally, *lightweight handoffs and interruptible resumption* keeps parallel participation viable under everyday disruption by making pauses, role switches, and resumption quick. A recurring example comes from co-play and family media use where interruptions are treated as normal, leading to design guidance that prioritizes interruptible experiences and return-friendly progress rather than penalizing users for stepping away [53, 83], and this logic is echoed in in-car family settings where interaction often involves shifting roles and intermittent attention [27].

Designing for parallel participation also surfaced several calibration challenges. Increasing shared-state visibility can strengthen alignment, yet some evidence suggests that collaboration can still hinge on adults' ability to facilitate and translate the activity in practice [108], and remote settings introduce additional work in managing what is shown to whom and when [154]. Likewise, enabling simultaneous input reduces waiting, but it can increase the likelihood of interference, contention, or attention capture by the device, particularly when timed or highly demanding mechanics pull focus away from interpersonal coordination [53]. Additionally, making activities more interruptible supports everyday rhythms, but it also raises questions about when system interruptions are helpful versus disruptive and how resumption cues should match the constraints of the setting, such as travel contexts where access and attention are uneven [27].

Overall, G7 highlights that sustained co-engagement is often supported by interaction infrastructures that let families contribute in parallel, remain oriented to shared state, and recover quickly from the pauses and role shifts that naturally occur in joint media use.

4.2.4 ***G8. Sustain Co-Engagement Across Time, Distance, and Family Routines***. Distance, competing schedules, and everyday interruptions can fragment family media use into brief, disconnected episodes. **G8** addresses this breakdown by treating co-engagement as something that needs continuity support, helping families preserve a felt sense of "being together" across gaps so they can reconnect without repeatedly renegotiating participation. Across the dataset, G8 appears in varied media contexts, with strong representation in communication media (e.g., family videoconferencing [2] and paired tangible tools for remote parent child connection [16]), alongside learning media (e.g., connected e-book co-reading with video chat [110] and creation-oriented coding kits that support sharing [91]), and wellbeing and behavior support systems (e.g., parent teen participatory mediation apps [69]). Intended child ages span early childhood through adolescence (approximately 0–18), with the clearest concentration in preschool and elementary years (roughly 2–12) and a smaller set of teen-focused systems that foreground family communication dynamics [35, 69, 110, 148]. In this evidence base, G8 most often appears when designers anticipate distributed co-use across time and places, and where sustaining shared participation depends on fitting family routines rather than assuming uninterrupted co-presence.

The literature operationalizes G8 through three interconnected strategies that together keep co-engagement viable across separation and return. *Remote and asynchronous co-engagement* provides lightweight ways to stay connected when family members cannot be present at the same time, so participation can continue through small contributions rather than requiring a scheduled session. For example, paired tangible communication devices let a child and caregiver exchange an asynchronous "wave," preserving affective contact without demanding simultaneous attention [16]. *Reconnection supports through shared artifacts and timing cues* then reduces re-initiation overhead by persisting traces of prior interaction and making it easy to resume shared activity after lapses. In connected co-reading, automatic reconnection and continuity of state help families rejoin quickly and continue where they left off [110]. Finally, *rituals, bonding, and mutual recognition* emphasizes durability through everyday fit, aligning interaction with routine moments and shared acknowledgment so repeated co-use feels natural rather than burdensome. Connected reading systems illustrate this approach by supporting variations in time, participants, and attention within familiar bedtime reading practices [35].

Translating these strategies into designs involves considerating some design tensions and balances. Designers may need to calibrate *flexibility versus richness and reliability*: lightweight asynchronous signals can lower coordination costs [16], while richer co-presence channels (e.g., adding video) can convey attention and affect but may be more fragile under bandwidth, device, or cost constraints [2, 147]. They also should balance *reconnection cues versus disruption*, since availability awareness and reminders can ease return [2] but overly salient prompts can clash with family rhythms or norms around moderate use [35, 84].

To sum up, G8 suggests that sustained co-engagement is better supported when systems couple distance-friendly participation with low-friction return paths and routine-compatible rituals, enabling families to reconnect, continue, and deepen shared activity across everyday gaps.

4.3 JME Design Goal III: Supporting Inclusive and Ethical Engagement

The third cluster of design guidelines (G9–G11) shifts from sustaining individual and co-engagement (Sections 4.1 and 4.2) to addressing conditions for inclusive, trustworthy, and responsible joint media engagement across diverse family contexts. Table 5 summarizes G9–G11 with their descriptions. These guidelines shift attention beyond interaction mechanics to the social, cultural, and ethical conditions that determine who can participate, on what terms, and with what risks. G9 centers inclusive participation across language, literacy, ability, resources, and cultural norms, prioritizing culturally grounded design over implicit defaults. G10 addresses privacy, data rights, and information boundaries, asking how systems support coordination without enabling surveillance or undermining trust. G11 focuses on safety and responsible participation by reducing harms from content, social interaction, and device use while preserving agency and easy disengagement.

4.3.1 ***G9. Ensure Inclusive, Culturally Grounded Participation***. Uneven access and cultural mismatch can exclude families from joint media engagement, so **G9** emphasizes designing for diverse languages, literacies, abilities, and practical constraints in the household through choices that are culturally grounded rather than implicitly normative. Across the included papers, this concern is operationalized through design choices that attend to cultural fit, communicative accessibility, developmental alignment, and practical feasibility under uneven access. These concerns arise across varied media contexts, with substantial representation in learning media (e.g., voice-driven learning experiences and basic-phone literacy systems [20, 79]), alongside wellbeing and behavior support, tracking and assistive, and connected home and smart-device media where interaction success depends on everyday household conditions and communication practices [11, 21, 105]. The guideline also appears in information-seeking settings where families engage with mainstream tools through culturally situated routines (e.g., collaborative web searching in bilingual households [106]). Intended age groups span early childhood through adolescence (approximately ages 0–18), with strong coverage of school-age children and early teens (e.g., 10–12 [79] and 10–17 [106]), while also including preschool contexts where foundational interaction constraints (such as voice input and adult mediation) shape who can participate [20]. Collectively, the dataset suggests G9 is most salient where systems risk assuming a single language, a single typical caregiver-child role pattern, or a single level of device access, and where participation hinges on fit with local routines, capabilities, and available infrastructure.

In practice, the papers often treat cultural grounding as a starting point for inclusive participation, then layer interaction and access decisions on top of that foundation. *Culturally grounded design and evaluation* foregrounds learning and coordination practices as culturally situated, motivating design

Table 5. Design guidelines for **Supporting Inclusive and Ethical Engagement** (G9–G11)

Guideline	Description	Identified Design Strategy	Child Age Group	Media Type
G9. Ensure inclusive, culturally grounded participation	Uneven access and cultural mismatch can exclude families, so design for diverse languages, literacies, abilities, and constraints through culturally grounded choices that fit local values and contexts.	***Culturally grounded design and evaluation:*** Use participatory, culturally responsive approaches that align with local values and avoid imposing normative role expectations.	0–11 [84]; 0–15 [98]; 2–16 [85]; 3–4 [65]; 3–5 [141]; 3–6 [148]; 4–6 [73]; 4–10 [58]; 5–10 [114, 153]; 5–11 [31]; 5–12 [5]; 6–11 [117]; 9–14 [128]; 10–17 [106]; 11–13 [81]	Entertainment media [65, 141]; Learning media [5, 31, 58, 73, 98, 114, 148, 153]; Information-seeking media [106]; Tracking and assistive media [117, 128]; Wellbeing and behavior support media [81, 84, 85]
		Language-and literacy-inclusive interaction: Provide multilingual and low-literacy supports and communication scaffolds for comprehension and expression.	0–16 [11]; 3–6 [145]; 4–7 [144]; 7–14 [105]; 10–12 [79]; 11–14 [21]	Connected home and smart-device media [11]; Learning media [79, 144, 145]; Tracking and assistive media [105]; Wellbeing and behavior support media [21]
		Capability-sensitive accessibility and developmental progression: Offer accessible modalities plus multiple entry points and graduated complexity aligned with children's development.	0–10 [130]; 1–10 [2]; 2–5 [110]; 2–10 [102]; 3–5 [20]; 3–6 [133]; 4–6 [4]; 5–9 [78]; 6–17 [77]; 7–10 [95]; 7–14 [105]; 8–15 [122]; 10–11 [32]; 14–18 [69]	Learning media [4, 20, 32, 77, 110, 130, 133]; Communication media [2]; Co-creative media [95, 102]; Wellbeing and behavior support media [69, 78, 122]; Tracking and assistive media [105]
		Resource-constrained access feasibility: Design for uneven access to devices, connectivity, space, and affordability so participation remains possible in resource-limited settings.	2–17 [124]; 3–13 [151]; 9–14 [128]	Tracking and assistive media [128]; Learning media [151]; Entertainment media [124]
G10. Protect privacy, data rights, and information boundaries	Family data is sensitive and default monitoring erodes trust, so support informed consent, appropriate sharing, and need-to-know awareness instead of surveillance by default.	***Minimize surveillance and support selective participation:*** Avoid continuous monitoring and allow less intrusive alternatives and temporary disengagement.	0–11 [84]; 3–8 [90]; 5–10 [37]; 7–10 [147]; 9–14 [128]	Tracking and assistive media [128]; Entertainment media [90]; Wellbeing and behavior support media [84]; Learning media [37]; Communication media [147]
		Consentful capture and fine-grained sharing controls: Provide clear, age-appropriate explanations and granular choices about capture, storage, and sharing.	2–17 [124]; 4–7 [75]; 6–12 [18]; 7–13 [6, 62]; 9–14 [128]; 10–15 [82]	Tracking and assistive media [18, 82, 128]; Entertainment media [62, 124]; Learning media [6]; Wellbeing and behavior support media [75]
		Privacy-preserving awareness and communication: Provide coordination features that reveal only what is necessary and protect private details.	5–12 [38]; 7–10 [147]; 9–11 [115]	Connected home and smart-device media [38]; Wellbeing and behavior support media [115]; Communication media [147]
G11. Support safety and responsible participation	Children can face harms from content, contact, and unsafe device operation, so reduce risk with protective safeguards, safe defaults, and clear limits that prevent harm.	***Age-appropriate content and non-coercive engagement safeguards:*** Ensure content is suitable and make stopping, skipping, and opting out easy, so engagement is not manipulative or hard to exit.	3–4 [65]; 3–8 [26]; 4–17 [38]	Connected home and smart-device media [26, 38]; Entertainment media [65]
		Safer social interaction and contact safeguards: Mitigate risks in communication and interaction (for example, harassment, stranger contact, unsafe exchanges).	3–8 [90, 118]; 3–13 [151]; 7–13 [6, 62]; 7–10 [147]; 11–13 [81]; 13–18 [39]	Wellbeing and behavior support media [39, 81, 118]; Learning media [6, 151]; Entertainment media [62, 90]; Communication media [147]
		Safe device operation and physical hazard reduction: Reduce physical hazards and support secure operation of devices in family settings.	2–17 [124]; 5–10 [37]; 8–12 [66]	Entertainment media [124]; Learning media [37, 66]

and evaluation that align with local values and avoid importing hidden assumptions about appropriate family role. For example, a study of collaborative online searching in bilingual Latino immigrant families characterizes children's information work through a familism lens and highlights how families rely on everyday platforms and translation tools as part of shared problem solving [106]. Building on such situated understanding, *language- and literacy-inclusive interaction* makes comprehension and expression feasible by supporting multilingual use and low-literacy communication scaffolds, such as voice-based interfaces that accommodate home language practices and reduce reading and typing demands [11], or basic-phone interactive voice response literacy systems that explicitly account for children's and caregivers' interaction difficulties through in-the-moment support and nudges [79]. *Capability-sensitive accessibility and developmental progression* then widens entry points by offering accessible modalities and graduated complexity aligned with children's development and interaction capabilities. One representative case is voice-driven educational play where designers account for parent-mediated "scaffolded speech" by treating adult support as part of the interaction loop rather than as noise, which reframes recognition and feedback design around how young children actually participate [20]. Finally, *resource-constrained access feasibility* addresses uneven connectivity, device availability, and ongoing costs by designing around families' existing technological resources. For instance, evidence from home learning ecosystems during COVID-era distance learning emphasizes supporting participation with whatever devices and platforms families already have, rather than assuming dedicated equipment or stable high-bandwidth access [151].

Translating these strategies into workable systems also involves recurring design balances. Extending multilingual, low-literacy, and voice-based supports can broaden participation, yet it also increases demands on recognition robustness, timing, and interaction clarity across varied home language practices and caregiver mediation patterns [11, 20, 79]. Likewise, capability-sensitive scaffolds can reduce breakdowns by meeting children where they are, but they often rely on adults to interpret, prompt, or co-produce interaction, creating a practical tension between widening access and keeping co-use effort sustainable in everyday routines [20, 79]. Finally, designing for low-resource feasibility and culturally grounded fit can pull against feature-rich assumptions embedded in dominant platforms, forcing trade-offs between tailoring to local infrastructure and practices versus maintaining consistent functionality across contexts [106, 151].

Overall, G9 frames inclusion as a problem of interactional and infrastructural fit: participation becomes more reliable when systems treat language, capability, resources, and cultural routines as first-class design parameters, so families can engage without having to translate, compensate, or reorganize their everyday practices just to take part.

4.3.2 ***G10. Protect Privacy, Data Rights, and Information Boundaries***

. Family data in JME is often intimate and relational, yet many systems normalize continuous sensing, logging, or sharing in ways that can erode trust and blur boundaries. **G10** addresses this risk by treating privacy as an interactional condition for co-use, supporting informed consent, appropriate sharing, and need-to-know awareness rather than default surveillance. Across the dataset, authors describe privacy support as a layered interaction problem, spanning how participation is initiated, how data is captured and shared, and how awareness is communicated during co-use. G10 appears most prominently in tracking and assistive media and wellbeing-oriented systems that surface sensitive behavioral or health information (for example, a situated tangible self-tracking system with a companion app [128], and collaborative child parent health tracking for pediatric diabetes [18]), while also extending to communication and connected home contexts where coordination features can unintentionally expose private details (e.g., a remote synchronous parent child media space [147] and smart speakers or interactive toys in the home [38]). Intended child ages span early childhood through adolescence (approximately 0–17), with much of the evidence concentrated in middle childhood and early adolescence where families negotiate growing independence alongside caregiver support (for example, ages 5–12 [38] and 7–10 [147] across several systems), while still including younger-child contexts shaped by parental mediation [84]. Overall, G10 most often appears when systems introduce persistent data traces or ambient awareness into everyday family life, making boundary management a prerequisite for sustained and comfortable co-engagement.

Practically, the literature often starts by reducing privacy risk at the level of participation itself. *Minimize surveillance and support selective participation* entails avoiding continuous monitoring as the default, and instead offering less intrusive alternatives, bounded sessions, or temporary disengagement so families can opt in without feeling watched. For example, designs for remote parent child connection emphasize making interaction more deliberate and bounded, such as using activation and spatial framing to create a privacy zone for use rather than assuming always-on connection [147], and related work in family support technologies highlights that participation may need to remain selective and situational as routines and comfort levels vary [84]. Building on this baseline, *consentful capture and fine-grained sharing controls* provides clear, age-appropriate explanations and granular choices about what is captured, stored, and shared, so that data practices remain legible and negotiable as family roles shift. One representative case comes from wearable capture in autism support, where parents reported deliberately not using recording in certain contexts and called for mechanisms that let others in the environment influence whether capture is permitted, underscoring the need for consent that is situated rather than assumed [82]. Finally, *privacy-preserving awareness and communication* focuses on coordination features that reveal only what is necessary for joint action while protecting private details, for instance by using constrained sensing, configurable parameters, or coarse-grained signals rather than high-fidelity exposure. In connected home settings, for example, parents explicitly weighed cameras against less revealing alternatives such as occupancy-style sensing and advocated for pre-configurable limits that better match children's privacy needs [38], while wellbeing-oriented systems similarly suggest tailoring what becomes visible and discussable based on family capacity and appropriateness of reflection [115].

Putting these approaches into practice requires designers to navigate a small set of recurring trade-offs. Specifically, designers need to calibrate *support versus intrusion*, since awareness features that help caregivers coordinate or support children can quickly read as surveillance if they are too continuous or too detailed [38, 147]. They also should balance *granularity versus burden*, because fine-grained consent and sharing controls can protect autonomy and relationships, yet can introduce friction and cognitive load for children, caregivers, and even surrounding third parties [82, 128]. Another related tension concerns *caregiver oversight versus child agency*, particularly in assistive and health contexts where families seek accountability and support but also need designs that preserve children's control over when and how personal data circulates within the family [18, 128].

In short, G10 suggests that privacy-respecting co-engagement will be strengthened when systems combine low-surveillance participation modes, legible consent and sharing choices, and need-to-know coordination, enabling families to collaborate with sensitive data while maintaining trust, comfort, and clear boundaries.

4.3.3 ***G11. Support Safety and Responsible Participation***. Children's co-use can be undermined when systems expose them to inappropriate content, unsafe social contact, or physical risks in device operation. **G11** addresses these risks by positioning safety as a condition for sustainable joint participation, so families can engage with clearer limits, safer defaults, and interaction pathways that reduce harm without making co-use feel precarious. In our dataset, G11 is evidenced through safeguards for content exposure, social contact, and physically situated device use. In terms of context, this guideline appears across connected home and smart-device media, entertainment media, learning media, wellbeing and behavior support media, and communication media, spanning platforms such as smart speakers and smart interactive toys in the home [38] and remote synchronous parent child media spaces designed for mediated communication [147]. Intended child ages range from early childhood through adolescence (approximately 2–18), with most evidence concentrated in preschool through early adolescence (roughly 3–13, e.g., [6, 90, 118, 151]), and fewer cases explicitly centered on older teens and family resilience contexts [39]. Within this evidence base, G11 most often appears when systems introduce open-ended content streams, networked interaction, or physically situated play that can amplify risk unless participation boundaries are made explicit and workable in everyday family settings.

The examined papers operationalize G11 by first shaping what children are exposed to and how easily they can disengage. *Age-appropriate content and non-coercive engagement safeguards* focus on making appropriateness and exit practical, e.g., by supporting family control over when and how systems can be used, and by avoiding designs that push continued engagement when interest or timing is misaligned. For example, in connected home settings, researchers describe features such as family-initiated non-use or time-bounded limits that allow households to pause interaction and reduce unwanted engagement pressure [38], while studies of children's media ecosystems highlight the role of content selection supports and recommendation mechanisms in guiding access to age-suitable material [65]. A second layer concerns the risks that emerge through communication and socially mediated use: *safer social interaction and contact safeguards* mitigates harm in interaction by constraining who can connect, what kinds of exchanges are possible, and what protective structures are available when systems involve communication or online participation. For instance, work on remote parent child communication systems emphasizes the need for designs that support safe supervision and reduce exposure to unwanted contact, particularly when children may use the system without continuous adult presence [147]; and complementary evidence frames trusted, bounded networks as a practical way to structure participation and manage social risk [39]. Additionally, *safe device operation and physical hazard reduction* address safety in embodied and mobile use by reducing hazards and supporting secure operation, especially when activities pull attention into the environment or rely on unfamiliar physical interfaces. In location-based augmented reality family play, for instance, designers discuss safety-oriented cues and mechanisms intended to help users stay aware of surroundings while engaging the game [124], and in tangible learning systems, participants' operational confusion points to the importance of physical interaction designs that prevent errors and support secure handling [37].

Meanwhile, the examined papers suggest that safety-supportive systems often require careful calibration between protective structure and everyday usability. Designs that strengthen limits or filtering can improve safety and appropriateness [38, 65], yet may need to preserve children's sense of agency and avoid turning co-use into constant negotiation or restriction [38, 147]. Similarly, expanding social participation can create valuable connection, but frequently pulls against the need to narrow interaction to trusted contacts and bounded channels [39]. In addition, richer and more immersive modalities can deepen engagement, while raising the bar for safe operation and attention management in practice [37, 124]. Overall, G11 indicates that co-engagement becomes more sustainable when systems align content, contact, and device safeguards with family routines, enabling participation that feels both inviting and reliably safe.

4.4 JME Design Goal IV: Promoting Positive Engagement Outcomes

The final cluster of design guidelines (G12–G14) shifts from supporting the quality, sustainability, and ethical grounding of interaction in earlier sections to ensuring that JME yields constructive, developmentally meaningful outcomes over time. In this section, we outline how systems can scaffold children's understanding through legible, appropriately challenging learning supports (G12), support in-the-moment self-regulation and socio-emotional growth during use (G13), and sustain positive outcomes across contexts by strengthening adult interpretation, coordination, and follow-through (G14). Table 6 provides an overview of G12–G14.

Table 6. Design guidelines for **Promoting Positive Engagement Outcomes** (G12–G14)

Guideline	Description	Identified Design Strategy	Child Age Group	Media Type
G12. Scaffold skill-building and understanding during engagement	Children may engage without understanding or feel overwhelmed by complexity, so provide instructional scaffolds in content and representations that keep learning legible and demands developmentally appropriate.	***Content structuring and complexity management:*** Organize learning content into developmentally appropriate chunks and progressions (for example, sequencing concepts, revisiting key ideas, and using examples) so children can understand what they are working on.	2–5 [110]; 3–4 [1]; 3–5 [71, 132]; 3–6 [133]; 3–8 [156]; 6–17 [77]; 7–10 [95]; 7–14 [30]; 10–11 [32]	Learning media [1, 30, 32, 71, 77, 110, 132, 133, 156]; Co-creative media [95]
		Representation and explanation supports that make learning legible: Use activity-embedded representations, hints, and explanations to connect actions to underlying ideas and clarify what the system is doing and why.	4–17 [38, 40]; 6–17 [77]; 7–9 [157]; 10–11 [32]; 10–12 [9]	Connected home and smart-device media [38, 40]; Learning media [9, 32, 77, 157]
		Strategy articulation and flexible transfer: Prompt children to explain their thinking and compare approaches, and support applying what they learned in new situations beyond the immediate activity.	4–7 [144]; 5–9 [123]; 5–12 [89]; 10–14 [76]	Entertainment media [89]; Learning media [76, 123, 144]
G13. Support self-regulation, wellbeing, and socio-emotional growth	Media engagement can dysregulate emotion, attention, and relationships, so support regulation during use and repair after tensions, building skills for healthier interaction over time.	***In-the-moment affect and attention regulation supports:*** Provide just-in-time supports that help children notice, manage, and recover attention or emotion during use.	0–11 [84]; 3–11 [16]; 5–11 [31]; 4–17 [40]; 11–14 [21]	Wellbeing and behavior support media [21, 84]; Communication media [16]; Learning media [31]; Connected home and smart-device media [40]
		Structured practice for socio-emotional competence: Provide repeated opportunities to practice prosocial habits and emotion understanding.	2–11 [134]; 3–8 [90, 116]; 5–9 [123]; 7–13 [62]; 8–15 [121]	Wellbeing and behavior support media [116, 134]; Entertainment media [62, 90]; Learning media [123]; Tracking and assistive media [121]
G14. Build adult capacity and reflective continuity across contexts	Support often breaks down across home, school, and care settings, so build adult capacity for interpretation and follow-through that carries insights into coordinated everyday practice across contexts.	***Adult guidance for support and interpretation:*** Provide resources that clarify what to attend to and how to respond constructively, without requiring tracking or continuous data capture.	3–4 [45]; 3–5 [71, 132]; 3–8 [26, 90, 125, 156]; 4–5 [57]; 4–6 [4]; 4–7 [75, 119, 144]; 4–17 [38]; 5–11 [31]; 6–8 [51]; 6–12 [18]; 6–17 [77]; 7–10 [95]; 8–12 [50, 66]; 8–15 [121]; 10–15 [82]; 11–13 [81]	Tracking and assistive media [18, 82, 121]; Connected home and smart-device media [26, 38]; Learning media [4, 31, 45, 50, 51, 57, 66, 71, 77, 119, 132, 144, 156]; Wellbeing and behavior support media [75, 81, 125]; Co-creative media [95]; Entertainment media [90, 119]
		Retrospective summaries and child-aligned tracking: Offer interpretable summaries and developmentally appropriate tracking that help adults see patterns and progress over time.	1–9 [132]; 2–3 [126]; 2–16 [85]; 3–8 [118]; 4–7 [75]; 7–12 [97]; 7–13 [62]; 7–14 [105]; 8–12 [50]; 8–15 [121]; 9–14 [128]; 10–15 [82]	Tracking and assistive media [82, 97, 105, 121, 128]; Wellbeing and behavior support media [75, 85, 118, 126]; Learning media [50, 132]; Entertainment media [62]
		Cross-setting coordination and distributed caregiving: Support communication and handoffs across people and settings to reinforce goals over time.	0–11 [84]; 1–10 [2]; 3–4 [90]; 4–7 [119]; 5–12 [38]; 7–10 [147]; 8–15 [122]; 13–18 [97]	Connected home and smart-device media [38, 97]; Communication media [2, 147]; Wellbeing and behavior support media [84, 122]; Learning media [90, 119]; Entertainment media [119]
		Carryover into everyday caregiving routines: Connect media activities to real-world routines and supports so insights translate into everyday follow-through across settings.	0–11 [84]; 0–16 [11]; 4–7 [119]; 6–13 [131]	Connected home and smart-device media [11]; Wellbeing and behavior support media [84, 131]; Learning media & Entertainment media [119]

4.4.1 ***G12. Scaffold Skill-Building and Understanding During Engagement***. Children may participate in media activities without grasping what the system is asking of them, or may disengage when demands escalate faster than their developing skills. G12 addresses this issue by encouraging instructional scaffolds that keep learning legible while preserving an appropriate level of challenge, so children can build understanding as they act rather than only after the fact. Across the dataset, this guideline is operationalized through layered supports that keep ideas interpretable during activity, pace complexity through developmentally appropriate progression, and encourage reflection that helps learning carry beyond the immediate interaction. Empirically, G12 is most common in *learning media* (e.g., parent–child story reading, informal AI literacy and museum-style activities, and vocabulary or math tools [1, 32, 76, 77, 144, 156]), and also appears in *connected home and smart-device media* such as smart speakers or connected toys that provide lightweight cues during interaction [38, 40]. The intended ages span from preschool through adolescence (approximately 2–17), with a notable concentration in early and middle childhood where foundational literacy, introductory computing ideas, and guided practice are common foci (e.g., [95, 156]), alongside a smaller set designed for broader family age ranges or older learners in AI literacy and connected-device contexts [40, 77]. In this context, G12 most often applies when systems introduce concepts, rules, or representations that can otherwise remain opaque in family co-use, and where scaffolding can help children stay oriented without turning interaction into rote instruction.

In practice, G12 is realized through complementary strategies that shape how children understand what they are doing and why. *Representation and explanation supports that make learning legible* focus on connecting actions to underlying ideas via interpretable cues, concrete analogies, or multimodal representations that families can discuss as they interact. One recurring instantiation is designing representations that support meaning-making and generalization, e.g., an AR vocabulary application that pairs target words with realistic 3D assets and representative sounds, offers multiple exemplars, and supports switching between realistic and stylized representations to match learning needs [32]. Building on this interpretability layer, *content structuring and complexity management* organizes activities into developmentally appropriate chunks and progressions so demands remain tractable as complexity increases. For example, in a family game-programming environment, families struggled to track continuous motion and rule conflicts as games grew more complex; the design implication was to offer higher-level procedures that bundle lower-level rules into manageable methods, reducing cognitive bookkeeping while enabling continued creation [30]. Finally, *strategy articulation and flexible transfer* prompts children (often with adult support) to explain approaches, compare alternatives, and apply strategies beyond the immediate activity so learning carries into everyday situations. For example, a hybrid SEL intervention supported transfer by helping families reuse story references to label everyday “hot moments” and recall strategies in situ [123], while home math activities prompted children to articulate coherent mathematical language for explanation and refinement during routine interaction [144].

At the same time, the papers highlight recurring trade-offs in how much support to provide and when. First, scaffolds that are too slow, trivial, or repetitive can undercut motivation, while overly difficult prompts can exceed children’s understanding; systems therefore may need to tune challenge and pacing to developmental stage and learner variability [156]. Second, increasing feature richness to reveal inner workings or provide explanatory visualizations can make experiences feel intimidating or overloaded, suggesting a balance between transparency and cognitive load via progressive disclosure, additional scaffolding, or even removing features that are “one too many” for novice users [77]. Third, highly realistic representations can aid contextualization and generalization, yet simplified or stylized representations may better support reinforcement and focused practice, implying a trade-off between ecological richness and instructional clarity even within the same activity flow [32].

Overall, G12 points to scaffolding as an interactional resource that can make learning demands navigable in the moment while preserving room for exploration. When these supports are calibrated to context and development, they can enable deeper engagement with challenging ideas and smoother family co-use that carries learning forward rather than ending at the activity boundary.

4.4.2 ***G13. Support Self-Regulation, Wellbeing, and Socio-Emotional Growth***. Media experiences can amplify frustration, distraction, or relational strain, especially when children are still developing strategies for managing attention and emotion. G13 addresses this interactional risk by orienting design toward supports that help families regulate during use and repair after tensions, while also building socio-emotional skills that can generalize beyond a single session. This guideline particularly appears in *wellbeing and behavior support media*, such as mobile interventions for adolescents' tech disengagement [21], fatherhood-supporting smartphone services [84], and emotion-regulation smart-toy interventions for parent–child co-regulation [134]. It also surfaces in *communication media* (e.g., paired tangible tools for remote affect sharing [16]), *tracking and assistive media* (e.g., family self-tracking with situated home displays [121]), *learning media* (e.g., hybrid SEL activities with embedded reflective prompts [123]), and *entertainment media* (e.g., VR co-watching scenarios with embodied tasks [62]). The associated ages span from early childhood through adolescence (approximately 0–17), with a clear concentration in early and middle childhood (roughly 2–11) where designs emphasize co-regulation and guided practice (e.g., [123, 134]), alongside a smaller set focused on adolescents' autonomy and self-management of technology routines [21, 121]. Within this dataset, G13 most often applies when systems are likely to encounter emotionally charged moments or shifting attention demands during family use, and where lightweight supports can reduce escalation while keeping interaction constructive.

Across the papers, this guideline is realized through two complementary layers. At the level of in-situ interaction, *in-the-moment affect and attention regulation supports* provide just-in-time cues that help children (and caregivers) notice, manage, and recover attention or emotion during use. For example, paired tangible tools for remote parent–child connection supported affect sharing by simplifying emotion inputs and enabling responsive, reassuring feedback when a child signals distress [16]; Work on adolescents' tech disengagement similarly foregrounded agency by supporting collaborative rule-setting, self-monitoring, and selective sharing with parents [21]. Additionally, *structured practice for socio-emotional competence* creates repeated opportunities to rehearse prosocial habits and emotion understanding through guided narratives and prompts. For instance, a hybrid physical-digital SEL intervention used story videos with embedded prompts to elicit reflection on personal experiences and characters' feelings and rehearse strategies in context [123], while an embodied smart-toy intervention similarly leveraged narrative scaffolds to cue repeated parent–child emotion coaching (e.g., validating and labeling emotions) during everyday use [134].

The examined papers also point to some design trade-offs. Specifically, regulation supports may need to balance child autonomy with moments where additional structure is helpful, especially for adolescents negotiating control with caregivers [21]. Meanwhile, designs that foreground emotion and reflection similarly require calibration: affect cues and coaching prompts can strengthen responsiveness, yet they may also increase worry or feel overly directive or burdensome if not lightweight and appropriable [16, 134]. Additionally, reflective feedback can support learning over time, but heavier data capture or persistent guidance may introduce friction, suggesting value in timely support that still tapers toward independence with minimal tracking burden [121].

Taken together, G13 suggests that regulation support is not only about dampening difficult moments, but also about creating developmentally appropriate opportunities for families to practice and internalize healthier interaction patterns. When calibrated to age and context, these supports can make joint media engagement more resilient in the moment while strengthening socio-emotional routines that carry into everyday family life.

4.4.3 ***G14. Build Adult Capacity and Reflective Continuity Across Contexts*** . Support for children's engagement may break down when adults lack the knowledge or interpretive resources to understand what children are doing and why, and when emerging insights do not carry across home, school, and care settings, leaving caregivers uncertain what to notice, how to respond, or how to follow through over time. G14 addresses this continuity gap by designing for adult-facing interpretability and coordination: helping caregivers make sense of children's activity and needs, share responsibility across people and settings when relevant, and carry insights into everyday routines without requiring constant monitoring. In the dataset, this guideline spans *tracking and assistive media* (e.g., smartwatch-based family self-tracking with a situated in-home reflective display [121]), *connected home media* (e.g., smart speakers and connected toys embedded in everyday family spaces [38]), *learning* systems where adult interpretation and follow-through influence whether benefits extend beyond a single session [144], and *wellbeing-oriented* systems that similarly rely on adults' ongoing sense-making and support [84]. The intended ages span infancy through late adolescence (approximately 0–18), with a strong concentration in early and middle childhood (i.e., 6–11) where adult interpretation and follow-through are frequently foregrounded (e.g., [84, 109, 118, 132]), and a smaller set addressing adolescents' increasing autonomy and wider networks of support (e.g., [97]). In this corpus, G14 most often applies when system benefits depend on adults noticing patterns, aligning expectations across contexts, and sustaining support after the immediate interaction ends.

One path to continuity is *adult guidance for support and interpretation*, which provides lightweight resources that clarify what to attend to and how to respond constructively, lowering the barrier for adults to participate supportively in the moment. For example, a voice-agent educational game provided parent-facing suggestions for reinforcing children's mathematical language during play [144], and smart-toy ecosystems likewise used onboarding and lightweight scaffolds to help adults take facilitative roles despite varied digital literacy [38]. A second path emphasizes *retrospective summaries and child-aligned tracking*, where systems offer interpretable summaries and developmentally appropriate views that help caregivers recognize patterns and progress over time. In a smartwatch-based family self-tracking system, an in-home display presented child- and caregiver-legible summaries that supported reflection and co-regulation with minimal added burden [121]. Continuity also depends on *cross-setting coordination and distributed caregiving*, which supports communication and handoffs across people and settings so adults can reinforce shared goals. For example, studies on children's portable device use foreground parent–school coordination in shaping media routines [119], while remote communication systems support distributed caregiving across distance rather than only co-located moments [147]. Finally, *carryover into everyday caregiving routines* connects media experiences to routines and supports so insights translate into concrete follow-through in daily life. A family smart-speaker deployment illustrates this orientation bA family smart-speaker deployment, for instance, positioned the voice interface as a way for children to access guidance in everyday routines even when caregivers were not immediately available [11].

The evidence also surfaces a few prominent trade-offs. Reflective summaries and visibility can support follow-through and coordination, but they need to remain unobtrusive in family activity and give families control over what is collected and shared [97, 121, 128]. Additionally, adult-facing guidance can reduce uncertainty, yet heavy onboarding or overly directive prompts may increase burden or limit appropriation, suggesting value in lightweight, optional supports that adapt to varied household routines and definitions of what is "normal" [38, 131, 144].

To sum up, G14 underscores that positive outcomes often hinge on adults being able to interpret, coordinate, and sustain support beyond the immediate session. When systems make follow-through feasible across settings and routines, they can help families maintain continuity that enables longer-term learning and wellbeing benefits.

5 Discussion

JME scholars often reflect on, discuss, and share design guidelines aimed at enhancing joint media experiences and technologies. However, these guidelines are typically disjointed and lack a systematic structure; each paper may offer only two or three implications related to specific design aspects (e.g., [123, 150, 156]). This fragmentation can be attributed to the fact that each JME case tends to focus on particular media contexts and analytical perspectives. To this end, a major contribution of the current work is systematically and comprehensively examining and synthesizing the existing while scattered JME design guidelines distributed across different papers, making them more accessible and easier for JME researchers and designers to use. Simultaneously, by synthesizing and organizing these design guidelines, our work advances the existing research on JME design principles by Takeuchi and Stevens [132] and others through ***developing a systematic design guide that consists of four JME design goals, specific design guidelines under each design goal, and the associated design strategies to support each design guideline.*** These design guidelines provide a comprehensive view of JME design, covering individual engagement, co-engagement, inclusivity, ethicality, as well as engagement outcomes. In doing so, our taxonomy of JME design guidelines is the first to systematically organize scattered design implications in the literature by aligning them with JME goals aimed at achieving productive JME. However, because it is grounded in the scope of existing published HCI studies, its comprehensiveness does not imply exhaustiveness. As new technologies and forms of media continue to evolve, especially with the rapid development and adoption of AI technologies like LLM, new forms of JME will inevitably surface. As a result, new design guidelines may be required. We, therefore, encourage researchers, designers, and practitioners to use our taxonomy as a foundation to build upon and extend JME design guidelines in the future.

Across the corpus, a recurring and sometimes counter-intuitive pattern is that ***more support is not always better support.*** Many systems aim to increase joint engagement by adding prompts, structure, monitoring, or safety constraints, yet the evidence shows these moves can backfire when they become overly directive, procedural, or surveillance-like: frequent interventions can interrupt conversational rhythm and dampen children's initiative, and visibility features meant to help coordination can erode trust if they blur into continuous observation (e.g., [18, 26, 53, 134]). ***Our synthesized guidelines therefore foreground design as calibration work.*** Rather than prescribing a single best way to do JME, the guideline set highlights how productive joint engagement hinges on keeping scaffolding adjustable and child-respecting, making roles and handoffs negotiable, and tuning boundaries (for privacy and safety) to developmental expectations and the specific risks of a given media setting. Next, building on our research findings about these design guidelines, we further reflect on the meaning and conceptual framing of productive JME (Section 5.1), as informed by the synthesized design guidelines, and offer recommendations for their critical application (Section 5.2).

5.1 Concretizing the Conceptual Meaning of "Productive" JME

As a relatively new concept that emerged in 2011, JME is gaining more and more attention from media researchers and designers, especially in the past five years [34, 152]. Even though HCI scholars have examined various JME activities in different media contexts, we still lack high-level design goals to guide JME practices, i.e., what are we designing for when designing JME? Through synthesizing the design guidelines reported in parent-child JME literature, we derive four design goals for JME: 1) *supporting sustained individual engagement,* 2) *supporting sustained co-engagement,* 3) *supporting inclusive and ethical engagement,* and 4) *promoting positive engagement outcomes.* The four design goals clarify and specify, for the first time in literature, what to aim for when designing joint media experiences and technologies for people's co-engagement, advancing the conceptual understanding of JME.

The four design goals also help illuminate the evolving understanding of what constitutes a productive JME. While Takeuchi and Stevens initially defined productive JME as media experiences that yield *"better engagement outcome"* [132], this definition may leave much room for interpretation, as the notion of a *"better engagement outcome"* can vary across contexts and stakeholders. This ambiguity could lead designers and researchers to optimize for mismatched or even harmful outcomes, such as prioritizing measurable participation over child wellbeing, equity, or family agency. As such, there is an opportunity to build upon this foundation by offering a more tangible and actionable framing that can better guide the design of meaningful JME experiences and technologies. At the same time, we recognize that arriving at a precise and universally applicable definition of productive JME is inherently challenging, given the diversity of joint media interactions and the varying needs and values of participants [152]. Drawing from the four JME design goals and the associated guidelines and strategies synthesized in our work, we suggest that productive JME can be understood not only in terms of achieving a *"better engagement outcome"* but also as a process characterized by sustained, inclusive, and ethical engagement. Accordingly, we propose an expanded framing of ***productive JME as deepened and sustained joint media experiences that are inclusive and ethical, and that lead to positive engagement outcomes.*** This expanded reframing aims to offer a clearer picture of what productive JME might look like, both in terms of engagement processes and intended outcomes, while also embracing the complexity of the media types, participant dynamics, interaction patterns, and usage contexts that shape JME. We hope that this more concrete perspective on productive JME proves useful for researchers and designers seeking more concrete guidance in fostering meaningful and effective joint media experiences.

5.2 Critically Applying the Developed JME Design Guidelines

Our developed guidelines can serve as practical references for JME experience and technology design, highlighting key considerations across participants' goals, capabilities, availability, cultural identities, and the physical and sociocultural contexts of JME. Specifically, we see two primary ways these guidelines can be applied in practice. First, ***as an analytical lens,*** the design guidelines can be leveraged to examine existing JME design and reveal opportunities for improvement. For example, previous studies have employed the six JME design principles proposed by Takeuchi and Stevens [132] to evaluate how specific activities support productive engagement among families (e.g., [13, 83, 124]), focusing on elements such as mutual engagement and co-creation. Compared to these earlier principles, our guidelines broaden the scope of analysis by highlighting a wider range of JME aspects, offering a more comprehensive framework for evaluation. Second, ***as a design guide,*** the guidelines can inform the development of engaging, ethical, and productive JME experiences and technologies. It translates insights from HCI scholarship into actionable strategies at both the experience level and across existing and emerging technologies, supporting designers in practice.

Note that these design guidelines should not be regarded as rigid principles for designing JME experiences and technologies. Instead, ***researchers, designers, and practitioners should situate these guidelines in their specific JME contexts and critically consider if a particular guideline can facilitate productive JME***. This recommendation is reinforced by our synthesized guidelines, which show that the guidelines are grounded in heterogeneous evidence across media types (e.g., learning media, connected home and smart-device media, communication media, tracking and assistive media, entertainment media) and span different child age ranges and caregiver roles, rather than being validated as uniformly effective interventions. We therefore treat "applicability" less as a property of a guideline itself and more as an emergent fit between a guideline's underlying interactional problem and a family's practical conditions, e.g., co-located vs. remote use, data sensitivity, developmental needs, household routines, and desired levels of adult mediation. For instance, strategies centered on developmentally aligned scaffolding and legibility (e.g., keeping demands tractable through content structuring and complexity management in G12 [158], or supporting capability-sensitive accessibility and developmental progression in G9 [23, 76]) are likely to generalize across many JME settings because they address recurring breakdowns in children's ability to participate meaningfully. In contrast, strategies that specifically presume distance, asynchronous contribution, or reconnection after gaps (e.g., remote and asynchronous co-engagement and reconnection supports in G8 [16, 110]) may be ill-suited for fully co-located, facilitator-led family co-making workshops where shared materials, synchronized participation, and in-person coordination are already central. Moreover, the synthesized guidelines surface not only within-guideline trade-offs but also cross-guideline tensions that require deliberate calibration. For example, designs that strengthen follow-through via reflective summaries and visibility (G14) can support coordination across time and caregivers [122], yet similar "making visible" moves can drift toward surveillance or boundary erosion if consent, need-to-know awareness, and selective participation are not foregrounded (G10) [38, 82, 148]. Likewise, stronger safety limits and safe defaults (G11) can reduce harm from content, contact, or unsafe device use [38, 65, 125], but overly restrictive controls may undermine autonomy and negotiation-oriented family mediation (G3, G5), particularly as children age and seek greater agency [21, 66]. Such variations are not contradictions to be resolved into a single best rule; rather, they reflect JME's broad scope and the way "productive" joint engagement is enacted differently across education, wellbeing, entertainment, communication, and everyday tracking contexts. Consequently, some guidelines may hinder design if imported without attention to context, so we recommend selecting, combining, and adapting guidelines based on the specific interactional risks and desired outcomes of the target JME setting, using the documented study contexts as a resource for this critical translation.

Another important dimension of context is children's age. Our findings show that the evidence base substantially covers early and middle childhood, while a relatively smaller subset extends into adolescence (e.g., cases spanning into the mid-to-late teens [43, 65]). As a result, guidelines that rely on intensive caregiver scaffolding, monitoring, or constraint-setting may fit younger children more naturally, but can conflict with adolescents' stronger expectations for autonomy, privacy boundaries, and peer-oriented participation. We therefore caution against directly applying the full guideline set to teen-only settings and recommend using the taxonomy as a starting point, then rebalancing strategies toward adolescent-appropriate agency, privacy, and social dynamics. A second, related dimension is cultural context: resonating previous HCI JME review [152], our findings show that the evidence base is geographically concentrated in Western settings (e.g., the USA accounts for the largest share of studies, with additional concentration in the UK and Canada; Figure 2), with comparatively fewer studies situated in East Asia and only scattered cases across other regions. Such skew suggests that some guidelines may implicitly reflect Western norms of parenting, mediation, communication styles, platform ecosystems, and expectations around autonomy and data boundaries. Accordingly, applying these guidelines in non-Western contexts may require careful cultural translation rather than direct adoption. We therefore recommend pairing guideline selection with culturally grounded design and evaluation work (e.g., G9) to surface local values, languages, caregiving arrangements, and community norms, and to recalibrate key trade-offs (e.g., autonomy versus protection, visibility versus privacy) in culturally appropriate ways.

Finally, the guidelines inherit the evidential strengths and limits of their source studies: none of the included papers evaluates a design guideline as a standalone intervention, so practitioners should interpret the guidelines as empirically grounded reflections rather than as prescriptions whose effectiveness has been formally compared, and treat them as provisional directions that may warrant further testing in their own contexts.

Limitations and Future Opportunities

We note three main limitations. First, although JME is broad, our review is limited to HCI and may miss relevant insights from communication, developmental psychology, and education. These adjacent literatures offer valuable empirical evidence on parent-child media use, but often do not foreground technology-specific design implications or detailed descriptions of interactive systems, limiting their fit for our synthesis. Our search terms also emphasized child-related language and, together with the current focus of HCI JME research, likely skewed the corpus toward younger children, even though some included studies addressed adolescents and teens. Practitioners should therefore avoid assuming that all guidelines transfer directly to adolescent contexts. Even within HCI, some relevant work framed under broader digital parenting or parental mediation, or published outside the venues we searched, may have been missed. Second, because our taxonomy is derived from existing studies, it may not yet capture emerging areas such as LLM-based media, even though the distilled goals and guidelines remain adaptable across contexts. Recent studies suggest that LLM-based systems can support parent-child engagement through adaptive scaffolding [52] and personalized interaction [19], while also raising tensions around control, values, and responsibility [50, 156]. We did not identify LLM-specific design guidelines in our corpus, likely because empirical HCI work on parent-child LLM use is still emerging and remains limited in family settings. Future work can therefore develop and evaluate LLM-specific guidance, while using our four JME goals as stable anchors for deciding when and how such capabilities should support productive JME. Third, synthesizing across diverse media, populations, and sociocultural settings necessarily reduces contextual detail, though this abstraction also supports broader generalizability. Overall, our work provides a foundation for translating JME design implications into practical guidelines. Future work can extend this foundation by incorporating perspectives beyond HCI, such as studies focused on learning and intergenerational JME (e.g., [101, 111]), and by further contextualizing the taxonomy around age appropriateness, cultural sensitivities, design tensions, and emerging technologies such as AI.

6 Conclusion

In this work, we extracted design guidelines from parent-child JME literature within HCI and synthesized them into a design guide. This guide includes four JME design goals, 14 JME design guidelines, and a set of associated design strategies, tensions and application contexts to support these guidelines. The design guide provides comprehensive design references for researchers, designers, and practitioners to create more productive JME experiences and technologies. Based on the guide, we redefine productive JME as joint media experiences that are deepened and sustained in inclusive and ethical ways that lead to positive engagement outcomes. Ultimately, we call for more researchers, designers, and practitioners to join the effort to continually explore and update design guidelines for JME.

Acknowledgments

We thank the reviewers for their valuable comments, which substantially strengthened this paper. This work was funded by The Hong Kong Polytechnic University (Project #: P0044773).

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A Appendices

Table 7. The HCI journals that we searched and are not archived in the ACM Digital Library

Journals	Journal Homepages
Advances in Human-Computer Interaction	https://www.hindawi.com/journals/ahci/
Behaviour and Information Technology	https://www.tandfonline.com/toc/tbit20/current
Computer Supported Cooperative Work (CSCW) [Springer]	https://www.springer.com/journal/10606
Computers in Human Behavior [Elsevier]	https://www.sciencedirect.com/journal/computers-in-human-behavior
Foundations and Trends in Human-Computer Interaction	https://www.nowpublishers.com/hci
Human Behavior and Emerging Technologies	https://onlinelibrary.wiley.com/journal/25781863
Human Factors: The Journal of the Human Factors and Ergonomics Society	https://journals.sagepub.com/home/hfs
Human-Computer Interaction (Taylor & Francis)	https://www.tandfonline.com/journals/hhci20
IEEE MultiMedia	https://ieeexplore.ieee.org/xpl/aboutJournal.jsp?punumber=93
IEEE Transactions on Affective Computing	https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5165369
IEEE Transactions on Human-Machine Systems	https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6221037
Information Technology and People	https://www.emeraldgrouppublishing.com/journal/itp
Interacting with Computers	https://academic.oup.com/iwc
Interaction Studies	https://www.jbe-platform.com/content/journals/15720381
International Journal of Ambient Computing and Intelligence (IJACI)	https://www.igi-global.com/journal/international-journal-ambient-computing-intelligence/1110#description
International Journal of Child-Computer Interaction (Elsevier)	https://www.sciencedirect.com/journal/international-journal-of-child-computer-interaction
International Journal of Human-Computer Interaction (Taylor & Francis)	https://www.tandfonline.com/toc/hihc20/current
International Journal of Human-Computer Studies (Elsevier)	https://www.sciencedirect.com/journal/international-journal-of-human-computer-studies
International Journal of Interactive Mobile Technologies	https://online-journals.org/index.php/i-jim
International Journal of Mobile Human Computer Interaction (IJMHCI)	https://www.igi-global.com/journal/international-journal-mobile-human-computer/1126
International Journal of Social Robotics [Springer]	https://www.springer.com/journal/12369
International Journal of Technology and Human Interaction (IJTHI)	https://www.igi-global.com/journal/international-journal-technology-human-interaction/1084
Journal of the Association for Information Science and Technology (JASIST)	https://asistdl.onlinelibrary.wiley.com/journal/23301643
Journal of User Experience	https://uxpajournal.org/all-issues/
Personal and Ubiquitous Computing [Springer]	https://www.springer.com/journal/779
Pervasive and Mobile Computing Journal	https://www.sciencedirect.com/journal/pervasive-and-mobile-computing
Quality and User Experience [Springer]	https://www.springer.com/journal/41233
Universal Access in the Information Society [Springer]	https://www.springer.com/journal/10209
User Modeling and User-Adapted Interaction [Springer]	https://www.springer.com/journal/11257/aims-and-scope

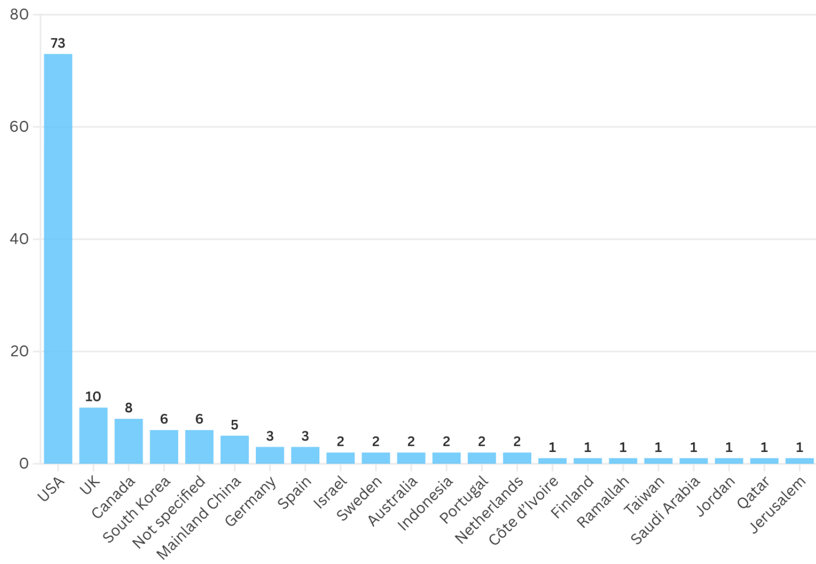

Fig. 2. Publication countries/regions of the sampled papers

Table 8. Synthesized design guideline set summarizing each JME goal, design guideline, guideline explanation, identified design strategy, relevant child age groups, and media types reported in the referenced papers.

JME Goals	Guidelines	Description	Identified Design Strategy	Child Age Group	Source Media Type
Supporting sustained individual engagement	**G1. Create inviting entry points that draw children into exploration**	Children may hesitate to start or not know how to begin, so reduce entry friction and make first actions immediately inviting through action-oriented, sensory-responsive interactions.	***Welcoming contexts and setup for easy starts:*** Configure routines, physical setup, and input arrangements so children can begin comfortably with minimal friction.	2-3 [126]; 2-5 [110]; 3-6 [43]; 3-7 [107]; 6-12 [100]; 7-14 [146]	Learning media [43, 107, 110]; Communication media [146]; Wellbeing and behavior support media [100, 126]
			Orientation cues and immediate feedback: Use clear prompts and engaging audiovisual feedback so children quickly understand what actions are possible and what to do next.	1–6 [49]; 3–5 [35]; 3–6 [43]; 3–11 [16]; 5–10 [37]; 5–15 [41]; 6–12 [27]; 7-10 [95]; 10–15 [82]	Wellbeing and behavior support media [49]; Learning media [35, 37, 41, 43]; Tracking and assistive media [82]; Communication media [16, 27]; Co-creative media [95]
			Hands-on exploratory entry through manipulables and tinkering: Center early tasks on manipulable materials and low-stakes creative iteration so children can touch, move, play, and experiment as a natural way to explore rather than aiming for a polished outcome.	2–11 [134]; 3-7 [107]; 3–9 [150]; 4–7 [75]; 5–10 [114]; 7-10 [95]	Wellbeing and behavior support media [75, 134]; Co-creative media [95]; Learning media [107, 114, 150]
	G2. Sustain motivation through personally meaningful experiences	Motivation fades when experiences feel generic or imposed, so ground engagement in purpose, lived-context relevance, and self-expression that helps children feel "this is for me."	***Narrative meaning through characters and goals:*** Use story contexts and roles to provide purpose and emotional tone independent of individual tailoring.	3-5 [125, 137]; 3–6 [133]; 3–8 [26]; 4–7 [75]; 4–17 [40]; 6–13 [131]	Wellbeing and behavior support media [75, 125, 131, 137]; Connected home and smart-device media [26, 40]; Learning media [133]
			Personal relevance through system tailoring: Tailor themes, pacing, and interaction pathways to children's lived contexts and interests.	2–5 [110]; 3–8 [116]; 3–9 [149]; 4-6 [74]; 4–7 [75]; 4–17 [38]; 5–9 [78]; 6–12 [61]	Learning media [74, 110, 149]; Communication media [61]; Wellbeing and behavior support media [75, 78, 116]; Connected home and smart-device media [38]
			Child-authored meaning through self-representation and reflection: Let children create and revisit artifacts that express who they are and reinforce "this is for me."	4–7 [75]; 7–10 [95]; 5–10 [114, 153]; 8–15 [121]; 7–13 [62]; 6–12 [61]	Wellbeing and behavior support media [75]; Co-creative media [95]; Learning media [114, 153]; Tracking and assistive media [121]; Entertainment media [62]; Communication media [61]
	G3. Maintain interaction flow with momentum and recoverability	Confusion and breakdowns can stall interaction, so design flow that keeps children oriented, supports recovery from errors, and preserves a sense of control.	***Flow cues and progress reassurance:*** Keep children oriented to what is happening and what comes next with clear progress cues, supportive responses, and normalized retries that sustain momentum.	1.5–9 [17]; 2–3 [126]; 3–5 [20]; 3–8 [26]; 4–7 [22, 144]	Learning media [17, 20, 22, 144]; Wellbeing and behavior support media [126]; Connected home and smart-device media [26]
			Breakdown-aware repair pathways: Anticipate misunderstandings and provide child-friendly ways to diagnose, undo, and continue after confusion or failure.	3–5 [20]; 0–16 [11]; 0–17 [12]	Learning media [20]; Connected home and smart-device media [11, 12]
			Autonomy and boundary-respecting control: Give meaningful control over choices, rules, and sharing, including ways to pause, adjust, or exit intrusive system behavior.	3–6 [54]; 3–13 [151]; 4–17 [38]; 6–13 [131]; 8–12 [66]; 9–14 [128]	Learning media [66, 151]; Wellbeing and behavior support media [54, 131]; Connected home and smart-device media [38]; Tracking and assistive media [128]

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Table 8. Synthesized JME design guideline set with goals, strategies, child age groups, and media types (Continued)

JME Goals	Guidelines	Guideline Explanation	Identified Design Strategy	Relevant Child Age Group	Media Type
	G4. Support sustainable re-engagement over time	Interruptions make returning hard, so support re-entry with feasible routines, preserved progress, and return-friendly structure that still works when the child comes back alone.	***Everyday fit through flexible configuration:*** Support portability across contexts and let families tune scope, timing, and effort so returning remains feasible within real schedules and constraints.	0–10 [130]; 3–5 [71, 132]; 3–8 [156]; 4–7 [119]; 7–10 [147]; 9–14 [128]	Tracking and assistive media [128]; Learning media [71, 119, 130, 132, 156]; Communication media [147]; Entertainment media [119]
			Re-entry continuity through saved state and modular progression: Preserve progress and provide recaps and return-friendly modules so children can resume smoothly after gaps while progression adapts to skill growth.	3–8 [26]; 6–12 [18]; 10–12 [15]	Learning media [15]; Tracking and assistive media [18]; Connected home and smart-device media [26]
			External supports that sustain participation when appropriate: Provide peer or community structures that help engagement persist beyond individual motivation.	3–8 [116]; 4–17 [38]; 10–15 [82]	Wellbeing and behavior support media [116]; Connected home and smart-device media [38]; Tracking and assistive media [82]
Supporting sustained co-engagement	**G5. Coordinate roles, shared agency, and system autonomy in joint engagement**	Joint engagement can become unbalanced or adult- or system-dominated, so clarify roles, support negotiation, and make system initiative adjustable so shared agency stays child-respecting.	***Balanced participation in cooperative play:*** Distribute influence and contribution opportunities so co-engagement feels reciprocal.	0–10 [130]; 2–4 [48]; 3–8 [156]; 3–17 [155]; 4–6 [53]; 7–10 [95]; 9–11 [115]; 9–12 [127]; 11–14 [7]; 13–17 [47]	Entertainment media [7, 53]; Wellbeing and behavior support media [47, 115, 127]; Co-creative media [95, 155]; Learning media [48, 130, 156]
			Negotiation supports for rules, turns, and decisions: Provide mechanisms to resolve disputes and make joint decisions constructively.	2–10 [102]; 4–5 [13]; 5–10 [153, 154]; 6–12 [18]; 7–13 [62]; 7–14 [146]; 8–12 [66]; 10–14 [140]; 10–14 [10]; 13–18 [39, 97]	Co-creative media [13, 102]; Connected home and smart-device media [97]; Learning media [10, 66, 140, 153]; Communication media [146, 154]; Tracking and assistive media [18]; Entertainment media [62]; Wellbeing and behavior support media [39]
			Caregiver mediation without taking over: Offer parent supports that help adults participate while preserving child ownership.	0–15 [98]; 1–9 [132]; 2–10 [102]; 2–11 [134]; 2–13 [64]; 3–5 [125, 141]; 3–6 [133, 145]; 3–9 [150]; 4–10 [58]; 5–12 [5]; 6–12 [18]; 7–14 [112]; 7–10 [95]	Wellbeing and behavior support media [125, 134]; Learning media [5, 58, 98, 112, 132, 133, 145, 150]; Co-creative media [64, 95, 102]; Entertainment media [141]; Tracking and assistive media [18]
			Adjustable agent roles and initiative: Make system autonomy understandable and configurable (for example, turn-taking, coach vs peer role, waiting for invitation).	1–6 [49, 132]; 1.5–9 [17]; 3–5 [56]; 3–8 [26, 156]; 4–5 [57]; 4–6 [28]; 4–17 [40]; 8–12 [50]; 8–15 [122]	Connected home and smart-device media [26, 40]; Learning media [17, 28, 50, 56, 57, 132, 156]; Wellbeing and behavior support media [49, 122]

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Table 8. Synthesized JME design guideline set with goals, strategies, child age groups, and media types (Continued)

JME Goals	Guidelines	Guideline Explanation	Identified Design Strategy	Relevant Child Age Group	Media Type
	G6. Scaffold collaboration and conversation in the moment	Co-engagement can falter when families lack structures for talk and coordination, so provide interactional scaffolds that prompt dialogue and help participants align actions during shared use.	***Conversation scaffolds for talk moves:*** Use prompts and cues that elicit caregiver-child dialogue during play and sensemaking.	1–6 [132]; 1–9 [132]; 3–5 [132]; 2–13 [64]; 3–6 [145]; 3–8 [26, 116, 156]; 4–7 [22, 75, 144]; 4–17 [40]; 5–9 [123]; 5–10 [158]; 5–12 [89]; 6–11 [117]; 6–12 [18]; 7–10 [95]; 7–12 [97]; 8–12 [66]; 9–11 [115]; 10–12 [9]; 10–14 [76]; 10–15 [42]	Co-creative media [64, 95]; Connected home and smart-device media [26, 40]; Tracking and assistive media [18, 97, 117]; Entertainment media [89]; Learning media [9, 22, 66, 76, 123, 132, 144, 145, 156, 158]; Wellbeing and behavior support media [75, 115, 116]; Communication media [42]
			Joint action structures for shared doing: Provide tasks, turn formats, and role routines that make doing together feasible and balanced.	1–9 [132]; 2–13 [64]; 3–8 [118]; 3–9 [149]; 4–5 [13]; 4–17 [40]; 6–12 [61]; 7–12 [97]	Co-creative media [13, 64]; Tracking and assistive media [97]; Wellbeing and behavior support media [118]; Communication media [61]; Learning media [132, 149]; Connected home and smart-device media [40]
			Coordination cues for role shifts and breakdowns: Provide lightweight guidance for handoffs, role changes, and moments of confusion so collaboration continues.	1–9 [132]; 3–5 [56]; 4–5 [57]; 7–9 [108]	Learning media [56, 57, 108, 132]
	G7. Enable parallel participation through co-use infrastructure	When family members move at different paces or take different roles, single-user interaction creates bottlenecks, so provide co-use infrastructure that enables parallel participation with low coordination overhead.	***Shared state and role-aware coordination cues:*** Make the joint activity legible (where you are, what changed, who did what, and what to do next) so participants stay aligned without one person narrating.	0–17 [29]; 0–10 [130]; 1–10 [2]; 2–5 [110]; 3–5 [35]; 3–17 [155]; 5–10 [154]; 6–12 [27]; 6–11 [117]; 7–9 [108]; 10–14 [136]; 10–17 [106]	Learning media [35, 108, 110, 130, 136]; Information-seeking media [106]; Communication media [2, 27, 154]; Entertainment media [29]; Tracking and assistive media [117]; Co-creative media [155]
			Multi-user input and parallel action: Support simultaneous contribution (for example, role-split inputs, multi-touch, parallel manipulation).	0–17 [12, 29]; 2–35 [89]; 3–17 [155]; 4–6 [53]; 5–10 [36, 154]; 6–12 [27]; 8–15 [121]; 10–14 [76, 136]	Entertainment media [29, 53, 89]; Connected home and smart-device media [12]; Learning media [36, 76, 136]; Co-creative media [155]; Tracking and assistive media [121]; Communication media [27, 154]
			Lightweight handoffs and interruptible resumption: Make pauses, role switches, and resumption quick so co-engagement survives everyday disruptions.	1–9 [132]; 3–8 [156]; 4–6 [53]; 4–17 [83]; 6–12 [27]; 10–12 [79]; 10–14 [76]	Entertainment media [53, 83]; Learning media [76, 79, 132, 156]; Communication media [27]

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Table 8. Synthesized JME design guideline set with goals, strategies, child age groups, and media types (Continued)

JME Goals	Guidelines	Guideline Explanation	Identified Design Strategy	Relevant Child Age Group	Media Type
	G8. Sustain co-engagement across time, distance, and family routines	Distance, schedules, and shifting participation fragment shared moments, so support reconnection and shared history that helps families resume "being together" across time and distance.	***Remote and asynchronous co-engagement:*** Enable participation when family members are apart while preserving social connection.	1–10 [2]; 2–5 [110]; 3–8 [156]; 3–9 [150]; 3–11 [16]; 4–17 [83]; 6–12 [61]; 7–14 [146]; 7–10 [147]; 8–12 [66]; 10–15 [42]; 14–18 [69]	Learning media [66, 110, 150, 156]; Wellbeing and behavior support media [69]; Communication media [2, 16, 42, 61, 146, 147]; Entertainment media [83]
			Reconnection supports through shared artifacts and timing cues: Persist and resurface joint creations, histories, or moments and reduce initiation overhead with scheduling, reminders, rendezvous supports, and prompts to rejoin, so families can reconnect and continue.	1–9 [132]; 1–10 [2]; 2–5 [110]; 4–5 [13]; 4–7 [75]; 4–17 [83]; 5–9 [123]	Co-creative media [13]; Entertainment media [83]; Communication media [2]; Learning media [110, 123, 132]; Wellbeing and behavior support media [75]
			Rituals, bonding, and mutual recognition: Design for shared enjoyment and acknowledgment aligned with everyday routines and transitions.	0–11 [84]; 3–6 [148]; 3–5 [35]; 3–8 [116]; 4–5 [13]	Co-creative media [13]; Learning media [35, 148]; Wellbeing and behavior support media [84, 116]
Supporting inclusive and ethical engagement	**G9. Ensure inclusive, culturally grounded participation**	Uneven access and cultural mismatch can exclude families, so design for diverse languages, literacies, abilities, and constraints through culturally grounded choices that fit local values and contexts.	***Culturally grounded design and evaluation:*** Use participatory, culturally responsive approaches that align with local values and avoid imposing normative role expectations.	0–11 [84]; 0–15 [98]; 2–16 [85]; 3–4 [65]; 3–5 [141]; 3–6 [148]; 4–6 [73]; 4–10 [58]; 5–10 [114, 153]; 5–11 [31]; 5–12 [5]; 6–11 [117]; 9–14 [128]; 10–17 [106]; 11–13 [81]	Entertainment media [65, 141]; Learning media [5, 31, 58, 73, 98, 114, 148, 153]; Information-seeking media [106]; Tracking and assistive media [117, 128]; Wellbeing and behavior support media [81, 84, 85]
			Language- and literacy-inclusive interaction: Provide multilingual and low-literacy supports and communication scaffolds for comprehension and expression.	0–16 [11]; 3–6 [145]; 4–7 [144]; 7–14 [105]; 10–12 [79]; 11–14 [21]	Connected home and smart-device media [11]; Learning media [79, 144, 145]; Tracking and assistive media [105]; Wellbeing and behavior support media [21]
			Capability-sensitive accessibility and developmental progression: Offer accessible modalities plus multiple entry points and graduated complexity aligned with children's development.	0–10 [130]; 1–10 [2]; 2–5 [110]; 2–10 [102]; 3–5 [20]; 3–6 [133]; 4–6 [4]; 5–9 [78]; 6–17 [77]; 7–10 [95]; 7–14 [105]; 8–15 [122]; 10–11 [32]; 14–18 [69]	Learning media [4, 20, 32, 77, 110, 130, 133]; Communication media [2]; Co-creative media [95, 102]; Wellbeing and behavior support media [69, 78, 122]; Tracking and assistive media [105]
			Resource-constrained access feasibility: Design for uneven access to devices, connectivity, space, and affordability so participation remains possible in resource-limited settings.	2–17 [124]; 3–13 [151]; 9–14 [128]	Tracking and assistive media [128]; Learning media [151]; Entertainment media [124]

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Table 8. Synthesized JME design guideline set with goals, strategies, child age groups, and media types (Continued)

JME Goals	Guidelines	Guideline Explanation	Identified Design Strategy	Relevant Child Age Group	Media Type
	G10. Protect privacy, data rights, and information boundaries	Family data is sensitive and default monitoring erodes trust, so support informed consent, appropriate sharing, and need-to-know awareness instead of surveillance by default.	***Minimize surveillance and support selective participation:*** Avoid continuous monitoring and allow less intrusive alternatives and temporary disengagement.	0–11 [84]; 3–8 [90]; 5–10 [37]; 7–10 [147]; 9–14 [128]	Tracking and assistive media [128]; Entertainment media [90]; Wellbeing and behavior support media [84]; Learning media [37]; Communication media [147]
			Consentful capture and fine-grained sharing controls: Provide clear, age-appropriate explanations and granular choices about capture, storage, and sharing.	2–17 [124]; 4–7 [75]; 6–12 [18]; 7–13 [6, 62]; 9–14 [128]; 10–15 [82]	Tracking and assistive media [18, 82, 128]; Entertainment media [62, 124]; Learning media [6]; Wellbeing and behavior support media [75]
			Privacy-preserving awareness and communication: Provide coordination features that reveal only what is necessary and protect private details.	5–12 [38]; 7–10 [147]; 9–11 [115]	Connected home and smart-device media [38]; Wellbeing and behavior support media [115]; Communication media [147]
	G11. Support safety and responsible participation	Children can face harms from content, contact, and unsafe device operation, so reduce risk with protective safeguards, safe defaults, and clear limits that prevent harm.	***Age-appropriate content and non-coercive engagement safeguards:*** Ensure content is suitable and make stopping, skipping, and opting out easy, so engagement is not manipulative or hard to exit.	3–4 [65]; 3–8 [26]; 4–17 [38]	Connected home and smart-device media [26, 38]; Entertainment media [65]
			Safer social interaction and contact safeguards: Mitigate risks in communication and interaction (for example, harassment, stranger contact, unsafe exchanges).	3–8 [90, 118]; 3–13 [151]; 7–13 [6, 62]; 7–10 [147]; 11–13 [81]; 13–18 [39]	Wellbeing and behavior support media [39, 81, 118]; Learning media [6, 151]; Entertainment media [62, 90]; Communication media [147]
			Safe device operation and physical hazard reduction: Reduce physical hazards and support secure operation of devices in family settings.	2–17 [124]; 5–10 [37]; 8–12 [66]	Entertainment media [124]; Learning media [37, 66]
Promoting positive engagement outcomes	**G12. Scaffold skill-building and understanding during engagement**	Children may engage without understanding or feel overwhelmed by complexity, so provide instructional scaffolds in content and representations that keep learning legible and demands developmentally appropriate.	***Content structuring and complexity management:*** Organize learning content into developmentally appropriate chunks and progressions (for example, sequencing concepts, revisiting key ideas, and using examples) so children can understand what they are working on.	2–5 [110]; 3–4 [1]; 3–5 [71, 132]; 3–6 [133]; 3–8 [156]; 6–17 [77]; 7–10 [95]; 7–14 [30]; 10–11 [32]	Learning media [1, 30, 32, 71, 77, 110, 132, 133, 156]; Co-creative media [95]
			Representation and explanation supports that make learning legible: Use activity-embedded representations, hints, and explanations to connect actions to underlying ideas and clarify what the system is doing and why.	4–17 [38, 40]; 6–17 [77]; 7–9 [157]; 10–11 [32]; 10–12 [9]	Connected home and smart-device media [38, 40]; Learning media [9, 32, 77, 157]
			Strategy articulation and flexible transfer: Prompt children to explain their thinking and compare approaches, and support applying what they learned in new situations beyond the immediate activity.	4–7 [144]; 5–9 [123]; 5–12 [89]; 10–14 [76]	Entertainment media [89]; Learning media [76, 123, 144]

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Table 8. Synthesized JME design guideline set with goals, strategies, child age groups, and media types (Continued)

JME Goals	Guidelines	Guideline Explanation	Identified Design Strategy	Relevant Child Age Group	Media Type
	G13. Support self-regulation, wellbeing, and socio-emotional growth	Media engagement can dysregulate emotion, attention, and relationships, so support regulation during use and repair after tensions, building skills for healthier interaction over time.	***In-the-moment affect and attention regulation supports:*** Provide just-in-time supports that help children notice, manage, and recover attention or emotion during use.	0–11 [84]; 3–11 [16]; 5–11 [31]; 4–17 [40]; 11–14 [21]	Wellbeing and behavior support media [21, 84]; Communication media [16]; Learning media [31]; Connected home and smart-device media [40]
			Structured practice for socio-emotional competence: Provide repeated opportunities to practice prosocial habits and emotion understanding.	2–11 [134]; 3–8 [90, 116]; 5–9 [123]; 7–13 [62]; 8–15 [121]	Wellbeing and behavior support media [116, 134]; Entertainment media [62, 90]; Learning media [123]; Tracking and assistive media [121]
	G14. Build adult capacity and reflective continuity across contexts	Support often breaks down across home, school, and care settings, so build adult capacity for interpretation and follow-through that carries insights into coordinated everyday practice across contexts.	***Adult guidance for support and interpretation:*** Provide resources that clarify what to attend to and how to respond constructively, without requiring tracking or continuous data capture.	3–4 [45]; 3–5 [71, 132]; 3–8 [26, 90, 125, 156]; 4–5 [57]; 4–6 [4]; 4–7 [75, 119, 144]; 4–17 [38]; 5–11 [31]; 6–8 [51]; 6–12 [18]; 6–17 [77]; 7–10 [95]; 8–12 [50, 66]; 8–15 [121]; 10–15 [82]; 11–13 [81]	Tracking and assistive media [18, 82, 121]; Connected home and smart-device media [26, 38]; Learning media [4, 31, 45, 50, 51, 57, 66, 71, 77, 119, 132, 144, 156]; Wellbeing and behavior support media [75, 81, 125]; Co-creative media [95]; Entertainment media [90, 119]
			Retrospective summaries and child-aligned tracking: Offer interpretable summaries and developmentally appropriate tracking that help adults see patterns and progress over time.	1–9 [132]; 2–3 [126]; 2–16 [85]; 3–8 [118]; 4–7 [75]; 7–12 [97]; 7–13 [62]; 7–14 [105]; 8–12 [50]; 8–15 [121]; 9–14 [128]; 10–15 [82]	Tracking and assistive media [82, 97, 105, 121, 128]; Wellbeing and behavior support media [75, 85, 118, 126]; Learning media [50, 132]; Entertainment media [62]
			Cross-setting coordination and distributed caregiving: Support communication and handoffs across people and settings to reinforce goals over time.	0–11 [84]; 1–10 [2]; 3–4 [90]; 4–7 [119]; 5–12 [38]; 7–10 [147]; 8–15 [122]; 13–18 [97]	Connected home and smart-device media [38, 97]; Communication media [2, 147]; Wellbeing and behavior support media [84, 122]; Learning media [90, 119]; Entertainment media [119]
			Carryover into everyday caregiving routines: Connect media activities to real-world routines and supports so insights translate into everyday follow-through across settings.	0–11 [84]; 0–16 [11]; 4–7 [119]; 6–13 [131]	Connected home and smart-device media [11]; Wellbeing and behavior support media [84, 131]; Learning media & Entertainment media [119]

Received 13 May 2025; revised 13 January 2026; accepted 17 March 2026