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Media Affordances and Pedagogical Quality of Indonesian Educational Apps for Young Children

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Abstract

Indonesia's Government Regulation on Child Protection in Electronic Systems (PP Tunas) restricts children's access to eight digital platforms, yet families lack evidence on which digital learning alternatives suit young children. This study aims to describe the pedagogical and communication affordance profiles of three selected Indonesian-language educational apps, namely Marbel Kids, Solite Kids, and Smarttick Indonesia, and to discuss their viability as alternatives under PP Tunas. A descriptive evaluative design was used. Apps were identified through a purposive, non-systematic search of app stores, assessed by the researchers through structured simulations using a 0–3 ordinal rubric that combines Media Affordance Theory with the Four Pillars of Learning, and complemented by naturalistic observations of four children aged 3–5 years. The results show different affordance profiles. Marbel Kids obtained the highest unweighted score (9/12), with strengths in ad-free engagement and contextual learning. Solite Kids (7/12) offered the broadest cultural and socio-moral content and the most affordable access, but advertising at feature transitions weakened engagement. Smarttick Indonesia (6/12) offered the greatest depth in structured mathematics, but its content was narrow and its design excluded parents during sessions. Social affordances supporting parent–child co-engagement were the least developed dimension in all three apps. The scores are descriptive heuristics, not measures of absolute quality. In conclusion, each app suits a different niche and none fully meets all dimensions of PP Tunas, so active parental mediation and a complementary combination of apps are needed. These preliminary findings require validation with a broader sample of apps.

Keywords: Educational Digital Application; Four Pillars of Learning; Media Affordance; Indonesian Digital Literacy; Early Childhood Education

Abstrak

Peraturan Pemerintah tentang Perlindungan Anak dalam Sistem Elektronik (PP Tunas) membatasi akses anak terhadap delapan platform digital, sementara keluarga belum memiliki bukti mengenai alternatif pembelajaran digital yang sesuai bagi anak usia dini. Penelitian ini bertujuan mendeskripsikan profil afordansi pedagogis dan komunikasi pada tiga aplikasi pendidikan berbahasa Indonesia yang dipilih, yaitu Marbel Kids, Solite Kids, dan Smarttick Indonesia, serta membahas kelayakannya sebagai alternatif di bawah PP Tunas. Penelitian menggunakan desain evaluatif deskriptif. Aplikasi diidentifikasi melalui pencarian purposif nonsistematis di toko aplikasi, dinilai oleh peneliti melalui simulasi terstruktur dengan rubrik ordinal 0-3 yang memadukan Teori Afordansi Media dan Empat Pilar Pembelajaran, serta dilengkapi observasi naturalistik terhadap empat anak berusia 3-5 tahun. Hasil menunjukkan profil afordansi yang berbeda. Marbel Kids memperoleh skor tertinggi tanpa pembobotan (9/12) dengan kekuatan pada keterlibatan bebas iklan dan pembelajaran kontekstual. Solite Kids (7/12) menawarkan konten budaya dan sosio-moral terluas serta akses paling terjangkau, tetapi iklan pada peralihan fitur melemahkan keterlibatan. Smarttick

Indonesia (6/12) menawarkan kedalaman terbesar pada matematika terstruktur, tetapi kontennya sempit dan desainnya menyisihkan orang tua selama sesi. Afordansi sosial yang mendukung keterlibatan bersama orang tua dan anak merupakan dimensi yang paling kurang berkembang pada ketiga aplikasi. Skor merupakan heuristik deskriptif, bukan ukuran mutlak kualitas. Simpulannya, setiap aplikasi cocok untuk ceruk yang berbeda dan tidak ada yang memenuhi seluruh dimensi PP Tunas, sehingga diperlukan pendampingan aktif orang tua dan kombinasi aplikasi yang saling melengkapi. Temuan awal ini memerlukan validasi pada sampel aplikasi yang lebih luas.

Kata Kunci: Aplikasi Digital Pendidikan; Empat Pilar Pembelajaran; Afordansi Media; Literasi Digital Indonesia; Pendidikan Anak Usia Dini

Introduction

Young children's use of smartphones and tablets has become routine in many households Radesky et al., (2020) and even toddlers can navigate touchscreen applications on their own (Jha, 2020). This early exposure raises questions not only about risk but also about the quality of the digital experiences available to children, because the educational value of an app depends on how it is designed and not on the fact that it is labelled educational (Hirsh-Pasek et al., 2015; Meyer et al., 2022).

As digital risks to children rise, ranging from exposure to harmful content and cyberbullying to online exploitation, the Indonesian government issued Government Regulation Number 17 of 2025 on the Management of Electronic Systems in Child Protection, known as PP Tunas. With effect from 28 March 2026, the regulation restricts children below a certain age from using eight major platforms: YouTube, TikTok, Facebook, Threads, Instagram, X (formerly Twitter), Bigo Live, and Roblox. Indonesia's move parallels a wider regulatory trend; Australia, for example, enacted the Online Safety Amendment (Social Media Minimum Age) Act 2024, which sets a minimum age of 16 for holding accounts on major social media platforms.

In the public debate that followed, a false choice has emerged between the view that children should not use social media and the view that children are deprived of learning resources. This framing wrongly treats general-purpose social media as the main source of digital learning for children. Evidence suggests that such platforms are not designed around the principles of optimal cognitive development for children (Adeyemi, 2025; Mbiriri, 2025). Educational apps with curated content, pedagogically grounded interactive features, and safety standards for child users are a more appropriate alternative, yet they have received limited systematic attention in policy discourse and academic research in Indonesia. Restricting access without pointing parents and teachers to alternatives may also leave a practical information gap, and similar concerns about weak policy dissemination have been noted in other Indonesian child-protection programmes (Lismawati, Mulyadi and Meigawati, 2025).

Two gaps motivate this study. The first is a contextual and practical gap. To our knowledge, Indonesian-language educational apps for young children have not been systematically evaluated, and international evaluations mostly concern English-language apps from other contexts, which may not meet Indonesian children's needs in language, culture, and accessibility (Radesky et al., 2020; Vaiopoulou et al., 2023). Because PP Tunas restricts access to certain platforms without indicating alternatives, parents, teachers, and policy makers lack an evidence base for judging which learning apps deserve consideration. The second is a theoretical integration gap: the combination of Media Affordance Theory and the Four Pillars of Learning for evaluating children's educational apps was not identified in the literature reviewed for this study, although that review was not a systematic literature search.

Accordingly, this study aims to (1) identify selected Indonesian-language educational apps that offer free and relevant content for young children; (2) describe the pedagogical and communication affordance profiles of each selected app; and (3) discuss the suitability of each app for different age groups and its viability as an alternative in the context of PP Tunas. The study evaluates selected apps and does not provide a comprehensive map of the Indonesian educational-app ecosystem. Theoretically, it offers an exploratory integration of Media Affordance Theory Treem and Leonardi (2012) and the Four Pillars of Learning Hirsh-Pasek et al., (2015) together with tentative conceptual propositions for further testing. Practically, it provides a preliminary reference that parents, educators, and policy makers can use, with caution, when considering digital learning options for young children. It also responds to concerns about digital literacy and the use of digital learning platforms in Indonesia (Afrina and Zulaikha, 2024).

This study draws on two theoretical frameworks. Media Affordance Theory is rooted in Gibson's (1979/2015) ecological concept of affordance and was developed for communication technologies by (Hutchby, 2001; and Treem and Leonardi, 2012). It conceptualizes technology not as a neutral tool but as an object with relational capacities that shape what users can and cannot do. For educational media, Bower (2008) distinguishes action, representational, epistemic, and social affordances, which relate to different aspects of the learning process. Affordance analysis of educational apps therefore goes beyond a feature inventory to examine the functional and pedagogical invitations that a design offers. The second lens, the Four Pillars of Learning framework Hirsh-Pasek et al., (2015) identifies active learning, engagement, meaningful learning, and social interaction as the four elements that digital media need to support children's learning. Most commercial apps marketed to children fall short on these criteria, emphasizing surface-level involvement over deeper learning Radesky et al., (2020) and parents' evaluations of app quality do not necessarily coincide with evidence-based pedagogical criteria (Vaiopoulou et al., 2021).

Because the two frameworks come from different traditions, their relationship needs to be stated explicitly. In this study, Bower's (2008) four affordance types are paired with the four pillars as an a priori, heuristic theoretical synthesis made by the authors before data collection, and not as a relationship derived from the data: action affordances are examined through the Active Learning pillar, representational affordances through the Engagement pillar, epistemic affordances through the Meaningful Learning pillar, and social affordances through the Social Interaction pillar. The pairing is not treated as an equivalence. Representational affordances, which concern how content is presented and signified, are broader than engagement, which is only one possible result of that presentation. Action affordances, which concern what a child can do with the interface, are not identical to active learning, which concerns minds-on cognitive activity and not only physical interaction. The pillars describe desired learning processes, whereas the affordances describe design properties that enable or constrain those processes. Each pillar is therefore used as the pedagogical criterion against which the corresponding affordance is judged, and the pairing is offered as a heuristic that needs further theoretical and empirical refinement.

Evaluations of children's apps with the Four Pillars framework have been critical. Meyer et al., (2021) found that most top-downloaded children's apps scored poorly on active learning and social interaction, with many relying on passive activities, advertisements, and reward systems that distract children from educational goals. Papadakis (2021) concluded that evaluation tools for children's apps must capture both technical functionality and alignment with child developmental theory, a dual standard that this study approaches by combining Media Affordance Theory and the Four Pillars

of Learning. Vaiopoulou et al., (2023) showed that app popularity is shaped more by perceptions of security and parental control than by learning quality, and that strong security features do not necessarily mean strong educational value, which highlights the need for multidimensional evaluation. Taylor et al., (2022) similarly reported that even highly rated preschool apps often lack effective feedback, adaptive learning features, and meaningful social interaction. Commercial design is a further concern: manipulative design features are common in mobile apps used by children Radesky et al., (2022) and apps played by preschool-aged children may collect and share user data (Zhao et al., 2020).

Systematic scholarly evaluation of Indonesian-language educational apps remains sparse, even though young children's use of digital devices is widespread. Such evaluation should also attend to developmental appropriateness. Zosh et al., (2018) describe play as a spectrum in which child agency, intrinsic motivation, and repeated exploration are central, and Konca (2022) argues that technology use in early childhood should be judged not by screen time alone but by whether it is purposeful, bounded, and embedded in guided play and interaction. Because adult involvement strongly shapes what young children learn from media, research on parent-child co-use and joint media engagement is also relevant: interaction around media, such as dialogic questioning, can support learning (Barr, 2019; Strouse et al., 2013). Young children's digital media use is further shaped by the sociotechnical context in which it is embedded, and well-intentioned platforms may reproduce dominant cultural logics if they ignore the linguistic, cultural, and economic contexts of their users (Mascheroni and Holloway, 2019). Research on digital inequality likewise shows that access to and use of digital technologies differ across socioeconomic groups (Livingstone and Helsper, 2007). Together, these perspectives provide the basis for evaluating and comparing the pedagogical and communicative affordances of Indonesian educational apps.

Methods

This study used a descriptive evaluative design that combined a researcher-led app evaluation using an ordinal rubric with qualitative observation notes. Apps were identified purposively, not systematically, in the Google Play Store and the Apple App Store using three inclusion criteria: developed by Indonesian developers, offering substantial free content, and using Indonesian as the main interface and content language. Candidates were checked for downloadability and tested through simulated learning and play, which left three interactive and accessible apps as the units of analysis: Marbel Kids, Smarttick Indonesia, and Solite Kids. Content was sampled purposively from basic cognitive skills (numeracy and literacy), arts, and character. Each app was rated on the four pillars of learning Hirsh-Pasek et al., (2015) using a four-level ordinal scale (0 = none, 1 = weak, 2 = sufficient, 3 = optimal) with operational definitions adapted from (Meyer et al., 2021; and Vaiopoulou et al., 2023). The profiles were then interpreted through Bower's (2008) affordance types using the heuristic pairing described in the Introduction. Summed scores are descriptive heuristics and are not used to rank the apps. The ratings were complemented by naturalistic observations of four children aged 3-5 years, supervised by an adult who was not always a parent. The study assessed built-in affordances, not actual parent-child co-use.

Result and Discussion

1. Educational Digital Landscape Mapping for Early Childhood Education in Indonesian Language: Who Is Present, Who Can Be Reached?

The analysis draws on two theoretical frameworks: the Four Pillars of Learning Hirsh-Pasek et al., (2015) as a pedagogical lens and Media Affordance Theory Treem and

Leonardi (2012) as a media-design lens. The three apps evaluated are Marbel Kids, Solite Kids, and Smarttick Indonesia. The analysis is based on structured observations of the features provided in the free edition of each app.

This section examines the availability, accessibility, and relevance of the selected Indonesian-language educational apps for young children. The apps were selected using three inclusion criteria: developed by Indonesian developers, entirely in Indonesian, and freely accessible. The three apps (Marbel Kids, Solite Kids, and Smarttick Indonesia) met all of them.

Table 1. Profile and Accessibility of Indonesian Language Early Childhood Education Applications

Criteria	Marbel Kids	Solite Kids	Smarttick Indonesia	Description
Developer	Indonesia	Indonesia	Indonesia	Meet the criteria
Interface language	Indonesian	Indonesian	Indonesian	Meet the criteria
Accessibility (free version)	Yes - limited features	Yes - limited daily time	Yes - 7 day trial period	All three apps have free versions with varying limitations
Target age	Early Childhood Education (0-6 years)	Early Childhood Education (2-6 years)	Early childhood education - elementary school (3-10 years)	Smarttick exceeds the early childhood education range
Content domain	Literacy, numeracy, basic science, fine motor skills	Literacy, numeracy, morals, socio-cultural skills, Islamic religion	Mathematics (comprehensive)	Solite kids is the broadest; Smarttick is the narrowest
Business model	Freemium (paid features)	Freemium (advertising + subscription)	Freemium (subscription after trial)	Business model may relate to pedagogical design (see below)
Child data protection	Not explicitly stated	Not explicitly stated	Parental registration is mandatory	Smarttick is the most stringent in parental verification

Table 1 shows that the three apps share Indonesian developers and an Indonesian interface but differ in content scope, business model, and access conditions. Their content includes culturally situated material, such as Indonesian folk stories, local occupations, and Indonesian traffic signs in Solite Kids, although developer origin and cultural content alone do not show how well the apps reflect the context of Indonesian child development. The apps are also not equally accessible. Marbel Kids has a limited set of free features, so children may soon meet this barrier as they progress. Solite Kids unlocks all features for free but imposes a daily time limit, which makes it the most financially accessible among the three. Smarttick Indonesia offers a seven-day, full-featured trial after which a subscription is required. This access model raises a theoretical concern that access may

vary with family economic capacity, a concern consistent with research on digital inequality (Livingstone and Helsper, 2007). This study collected no data on users' socioeconomic status, however, so the concern is not an empirical finding. Evidence from border communities in West Kalimantan points in the same direction: weak signals, high costs, and limited devices constrain the benefits of internet use, and the community expects affordable access and digital literacy training (Kusnanto et al., 2025).

All three apps are relevant to young children's media use in that they are available as mobile apps with touchscreen interfaces, which is how young children commonly access digital media (Radesky et al., 2020). They therefore meet the basic criteria of availability and relevance to be considered as possible alternatives for digital learning that deserve further exploration.

2. Behind the Colorful Icons: Revealing the Pedagogical and Affordance Profiles of Three Platforms

The second question of this study involves a deeper analysis: not only what is offered, but what is enabled, and indirectly what is hindered, by the design of each app. The analysis takes place on two layers: assessment through the Four Pillars of Learning rubric, and identification of media affordance profiles through Bower's (2008) taxonomy, paired with the pillars heuristically as described in the Introduction. The pedagogical pillars describe what should happen in a child's learning process, and the affordance profiles describe why a particular media design makes this possible or difficult.

Table 2. Results of the 4 Pillars of Learning Assessment on Three Early Childhood Education Platforms

Pillar	Measured Dimensions	Marbel Kids	Solite Kids	Smarttick	Comparative Notes
P1 - Active Learning	Child agency, interactivity, depth of cognitive processes	2/3	2/3	2/3	All platforms move beyond simple stimulus-response models, but none have reached open-ended learning. Activities remain closed-loop.
P2 – Engagement	Advertisements, feedback, pedagogical gamification	3/3	1/3	2/3	Marbel Kids scores markedly higher. Solite Kids is weakened by advertisements during feature transitions. Smarttick is hindered by rigid audio and formal diction.
P3 – Meaningful Learning	Real-life relevance, knowledge transfer	3/3	3/3	2/3	Marbel Kids and Solite Kids are comparable through different epistemic pathways. Smarttick is mathematically strong but lacks real-world contextualization.

P4 – Social Interaction	Parent co-engagement, parasocial relationships, post-screen interaction	1/3	1/3	0/3	There is a structural gap across platforms. Smarttick's design positions sessions as the child's independent time and asks parents to step away, which is categorized here as an anti-social affordance (tentative).
Unweighted sum (descriptive heuristic only)	—	9/12	7/12	/12	The sums are shown only to summarize the profiles. The scale is ordinal and the pillars are not assumed to be equally weighted, so the sums are not a ranking or a measure of overall quality.

Researchers' ordinal ratings based on structured observations. Scoring scale: 0 = none; 1 = weak; 2 = sufficient; 3 = optimal.

On the active learning pillar, all three apps scored the same (2/3). This is not a coincidence but a reflection of the limitations of the dominant mobile educational app format. Marbel Kids provides meaningful cognitive activities through puzzles, color matching, and sequences of steps such as planting or shopping. Solite Kids offers two paths within each feature: a declarative-receptive learning mode and a more interactive play mode. Smarttick Indonesia offers the most structured difficulty progression, from selecting the same shape to selecting shapes and colors with increasingly more options. However, all three apps stall at the same point: none allows open-ended problem solving, an activity that Hirsh-Pasek et al., (2015) call minds-on, where the child determines the direction of exploration. All three apps designed their activities in a guided, closed-loop format, a common design choice for early childhood apps that suits the scaffolding needs of this age range. Scaffolding features in educational apps, including verbal hints and gradual leveling, support young children's learning, and scaffolded feedback is most effective when it is introduced at the beginning of app play and when difficulty levels progress incrementally rather than randomly (Callaghan and Reich, 2021). This suggests that none of the three apps fully draws on these scaffolding principles, which may matter particularly for children at the higher end of the target age range, where the absence of adaptive challenge may limit opportunities for self-regulation and autonomous problem solving.

The engagement pillar is where the apps vary the most. Marbel Kids achieved the highest score (3/3) because it is free of advertising, its feedback encourages retry without interrupting gameplay, and it uses pedagogically conscious diction: the app chose the word play over learning, a small design decision that may shape how children perceive the activity. Solite Kids achieved only 1/3, the largest gap between apps across the entire matrix. Ads are present at every transition between features, creating what Bower (2008) calls competing affordances: two media signals competing for the same attention and thus weakening each other. This appears to be a structural consequence of the ad-supported freemium business model, which suggests that an app's pedagogical qualities may not be separable from its economic model, a concern consistent with evidence on manipulative

design in children's apps (Radesky et al., 2022). Smarttick achieved a middle ground (2/3): it is ad-free, but it is hampered by stiff audio, overly formal language, and a habit of immediately displaying the correct answer without giving children a chance to try again.

On the meaningful learning pillar, Marbel Kids and Solite Kids both achieved 3/3 through different epistemic pathways, an observation that leads this study to propose, tentatively, an analytical differentiation. Marbel Kids constructs meaning through direct contextualization: children shop according to a list, plant plants in the correct order, and group objects into everyday categories. Knowledge is presented not as loose facts but as practices embedded in concrete situations. Solite Kids achieved the same score through a more culturally expansive pathway, offering the most diverse spectrum of content: brushing teeth, professions, traffic signs, the Si Kancil moral fable, August 17 celebrations, and Indonesian geography. Smarttick achieved only 2/3 because, while it offers exceptional epistemic depth in mathematics, it offers little real-life contextualization. This discrepancy suggests the tentative proposition that epistemic affordances may need to be examined along two dimensions, depth and breadth. Smarttick is an example of deep and narrow affordances, while Solite Kids is an example of broad and shallow affordances, two patterns that produce similar scores but may have different pedagogical implications. This proposition is derived from three cases and requires validation with a wider sample of apps.

Table 3. Communication and Pedagogical Affordance Profile of Three Platforms (Heuristic Pairing of Bower's affordance Types With The Four Pillars)

Type of Affordance	Marbel Kids	Solite Kids	Smarttick	Findings and Theoretical Interpretation
Action Affordance (P1 – Active Learning)	Present – Limited (closed-loop; puzzle and matching activities with progression)	Present – Limited (dual mode; interactive play, passive-receptive learning)	Present – Limited (over-scaffolded; child agency is highly restricted)	All three platforms provide action affordances beyond simple stimulus-response thresholds, yet none offer open-ended affordances. Touchscreen interactivity does not automatically equate to active learning.
Representational Affordance (P2 – Engagement)	Optimal (ad-free; supportive audio-visual design; child-friendly diction)	Degraded (ads at every transition: competing affordances)	Partial (ad-free; tutorial videos available; however, rigid audio and formal language)	Tentative interpretation: the business model may shape the quality of representational affordance. Solite Kids illustrates how an ad-based freemium design can degrade it.

Epistemic Affordance (P3 – Meaningful Learning)	Strong and Contextual (shopping, planting — knowledge embedded in real-life contexts)	Broad and Cultural (most diverse: morality, nationalism, religion, science, culture)	Deep and Narrow (comprehensive mathematics; not cross-domain)	Two patterns emerged: broad and shallow (Solite Kids) versus deep and narrow (Smarttick). This dichotomy is offered as a tentative conceptual proposition: epistemic affordance may need to be examined across depth and breadth.
Social Affordance (P4 – Interaction)	Minimal (no parent co-engagement features in the free version; worksheets are paid)	Minimal and Overlooked (high potential for moral discussion but unsupported by design)	Anti-Social Affordance (parents are asked to leave children before the session)	None of the apps provides substantial built-in social affordances. Smarttick's design illustrates what is termed here an anti-social affordance (tentative): the design removes children's natural social mediators rather than merely failing to provide them.

In terms of social interaction, all three apps are designed primarily as individual experiences for children, with varying degrees of parental involvement. Marbel Kids and Solite Kids position children as the primary users interacting with the apps' characters and systems; parental involvement is not explicitly built into the main flow, although it is contextually possible. Smarttick Indonesia takes a different approach: it explicitly designs learning sessions as the child's independent time, on the assumption that uninterrupted focus supports structured learning habits. These differences reflect differing orientations toward the parental role, from leaving it open to deliberately redefining it. From the perspective of social affordances Bower (2008) all three apps provide limited space for direct, parent-mediated interaction within the app. Research on joint media engagement suggests that adult interaction around media can support young children's learning Barr (2019); Strouse et al., (2013) which makes the absence of built-in co-use support a notable gap and an area for future development. This study, however, assessed only the affordances built into the apps and not actual parent-child co-use, and the adults supervising the observations were not always parents. How the designs actually shape co-engagement therefore cannot be concluded from these data.

Overall, Table 3 shows that the three platforms have distinct and complementary capability profiles. Marbel Kids excels in representational skills with a clean and contextual learning environment. Solite Kids excels in culturally broad epistemic skills. Smarttick Indonesia excels in structured action skills and deep epistemic skills in mathematics. These differences in profiles do not constitute a hierarchy of quality, but rather reflect different orientations and segmentations.

3. Viability of the Three Apps as Alternatives After PP Tunas

The third question puts the three platforms in a broader policy context: how viable they can be as alternatives - appropriate, functional, and pedagogically accountable - after the Government Regulation on the Governance of Electronic Systems for Child Protection (PP Tunas) is enacted. Tunas regulation was established to respond to increased concerns over the digital ecosystem's influence on Indonesian children, including as exposure to hazardous content, exploitative data gathering, and platform mechanics that encourage screen addiction. In this sense, the question of viability is not just whether the platform is available and functioning, but whether it actively supports the healthy, safe and protected growth of children.

Table 4. Platform Viability Assessment as an Alternative After the Implementation of the Tunas Regulation

Dimension of Alignment with the Tunas Regulation	Marbel Kids	Solite Kids	Smarttick	Policy Implications
Safe Content and Free from Violence/Adult Content	Meets the criteria	Meets the criteria	Meets the criteria	All three apps are safe in terms of the content sampled. No violent, sexual, or exploitative material was identified.
Parental Supervision (Parental Gate and Control)	Partial (free mode without parental controls)	Partial (parents cannot monitor children's activities)	Relatively meets the criteria (mandatory registration; progress reports via email)	Only Smarttick requires parental involvement during registration, although paradoxically excluding them during learning sessions.
Support for Holistic Child Development	Good (cognitive, motor, literacy, numeracy)	Very good (cognitive, moral, socio-cultural, emotional)	Narrow (limited to mathematics only)	Tunas regulation mandates holistic child development. Solite Kids is the most relevant, while Smarttick is the most limited.
Minimization of Addiction Risk and Excessive Screen Time	No built-in time limits	Daily time limits (free version)	Limited-duration sessions (active time-cycle system)	Solite Kids and Smarttick include built-in duration-limiting mechanisms aligned with the principles of Tunas regulation.
Free from Advertisements and Exploitative Commercial Practices	Ad-free	Does not meet the criteria (ads at every feature transition)	Ad-free (trial period)	Tunas Regulation mandates protection from exploitative commercial content. Solite Kids is problematic in this dimension.

Facilitation of Parents' Role as Learning Mediators	No built-in facilitation identified	No built-in facilitation identified	Design positions sessions as the child's independent time	The most critical weakness across apps, in terms of built-in affordances, relates to the mandate of the Tunas regulation on parents' responsibility in accompanying children in digital spaces. Actual co-use was not assessed.
Accessibility for All Groups (Price Inclusivity)	Partial (free with highly limited features)	Good (all features free with daily time limits)	Partial (7-day free trial; subscription relatively expensive)	Solite Kids is the most financially accessible among the three. Smarttick may become financially exclusive after the trial period (a theoretical concern, not an empirical finding).
Overall Viability Assessment Post-PP Tunas	Viable with notes	Conditional ly viable	Limited viability	No platform fully satisfies all dimensions. A combination of platforms and active parental mediation is still required.

Marbel Kids aligns with several key dimensions of the Tunas regulation: no unsafe content was identified in the content sampled, and it contains no ads. It does not explicitly state how children's data are handled (Table 1), which matters because apps used by preschool-aged children may collect and share user data (Zhao et al., 2020). Its clean and contextual pedagogical profile makes it a good choice for parents seeking a curated digital environment for their children. In the context of the Tunas regulation, Marbel Kids can serve as a primary app, provided that parents consider its access model: core content is free, while additional content requires purchase. This is a characteristic of the model that users should understand from the outset.

Solite Kids offers a different profile. Its primary strength lies in its financial accessibility and in the depth of Indonesian cultural content that the other apps lack, a scope that encompasses character education, cultural literacy, and national values relevant to the national education mandate. In the context of the Tunas regulation, the presence of ads in transitions between features requires careful attention, especially given the emphasis on protecting children from commercial exposure. However, ads do not appear while children are actively interacting with the content, and the app's integrated daily time limits align with the commitment of the Tunas regulation to limiting screen time. Solite Kids can function as a general knowledge and character enrichment app with active parental guidance during the transitions between features.

Smarttick Indonesia has a clearly defined value proposition: systematic and measurable reinforcement of mathematics for children from preschool to early elementary school. Its parent engagement tools, such as mandatory parental registration and regular progress reports, are consistent with the emphasis of the Tunas regulation on parental responsibility. Its design philosophy, which frames learning sessions as the child's own time, reflects a pedagogical approach focused on fostering independence and attentiveness. In the context of the Tunas regulation, Smarttick Indonesia is best positioned as a structured supplementary app that adds to, and does not replace, learning interactions with parents outside the app. The three apps thus occupy different niches in

children's digital learning. Marbel Kids is best used as a clean, contextual main exploration space, Solite Kids as a gateway to Indonesian culture and character knowledge, and Smarttick Indonesia as an organized and measurable way to reinforce numeracy. A portfolio approach in which the three apps are used in a complementary way as needed may provide broader coverage of children's development, and the framing of parents as key gatekeepers of children's digital ecology in the Tunas regulation leaves room for this kind of active curation. Because the apps themselves offer little support for parental mediation, this recommendation of active parental guidance rests on research on parent-child co-use and joint media engagement Barr (2019); Strouse et al., (2013), not on evidence from this study about actual co-use.

Conclusion

This study examined three selected Indonesian-language educational apps (Marbel Kids, Solite Kids, and Smarttick Indonesia) as possible alternatives for young children in the context of PP Tunas, combining Media Affordance Theory and the Four Pillars of Learning. The apps showed distinct affordance profiles. Marbel Kids obtained the highest unweighted score (9/12), with strengths in ad-free engagement and contextual learning; Solite Kids (7/12) offered broad cultural content but was weakened by advertising; and Smarttick (6/12) offered deep but narrow mathematics. These scores are descriptive heuristics, not a ranking of quality. Under PP Tunas, the apps suit different roles, namely a primary exploration space, a culture and character enrichment resource, and a numeracy supplement, and are best used together with active parental mediation. Social affordances for parent-child co-engagement were the least developed dimension in all three apps, so developers should consider co-play features and reconsider advertising-based models. The findings are tentative because of the purposive selection of three apps, researcher-based ratings, four observed children, and the absence of data on actual co-use. Future research should evaluate larger, systematically sampled sets of apps, test effects on learning outcomes, and observe parent-child dyads.

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