

**A Framework of Touchscreen Interaction Design Recommendations for Children (TIDRC):  
Characterizing the Gap between Research Evidence and Design Practice**

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Interface Dimensions		Evidence-Based Design Recommendations Related to Cognitive, Physical, and Socio-Emotional Needs of Children
<b>Cognitive</b>		
Visual Design Features	<b>Graphics (G)</b>	1. Be consistent with images or graphical metaphors used in interfaces and their real world use [3]. (ages 2-7) 2. Remove visual embellishments from symbols to support children’s limited capability for symbol-referent mapping [12,17]. (ages 2-7) 3. Use child-like on-screen characters as guides or pedagogical agents to improve learning outcomes [7,11]. (ages 2-11)
	<b>Application Background (B)</b>	4. *Avoid using interface designs with lots of different colors or shades [12]. (ages 2-7) 5. Avoid using visually complex application backgrounds as children can get confused when interacting on them [3]. (ages 2-7) 6. *Make foreground items of the interface clearer and more detailed than the background items [12,18]. (ages 2-7)
	<b>Text Font Size (F)</b>	7. Use a minimum of 14-point font size to help children read faster [5]. (ages 7-11) 8. *Avoid using Times font style as children report it to be significantly less easy to read [5]. (ages 7-11)
Audio Features	<b>Types of Sound (S)</b>	9. *Make sure that every sound used in the interface has a specific meaning and function [12]. (ages 2-7) 10. Avoid using background music with videos, especially for children ages 5 and under [6,27]. (ages 2-7) 11. Consider using narrative-style sound elements as they foster children’s language development [21,29]. (ages 2+) 12. Use audio features (e.g., sound effects, vocalization) to draw attention to important content for learning purposes [6,12]. (ages 2-7)
Interactive Features	<b>Clickable Items (CI)</b>	13. Visually differentiate clickable elements from the rest of the screen, e.g., use different colors or dark outlines [12,27,30]. (ages 2-7) 14. *Avoid placing small interactive elements at the screen edges, especially in visually complex interface designs [31]. (ages 2-11) 15. Be careful when using animated hotspots to capture children’s attention as they may distract from learning [28,29]. (ages 2-11) 16. Limit the behavior of interactive elements to their sole purpose, e.g., avoid extraneous animations or sounds [12,29]. (ages 2-11)
	<b>Menu Complexity (M)</b>	17. Avoid using hierarchical menus as young children may have difficulty navigating these successfully [7,10,18]. (ages 2-11) 18. *Provide a means to reverse children’s actions in order to support their exploratory behavior [18]. (ages 2-7)
	<b>Interaction Prompts (I)</b>	19. Provide explicit scaffolding such as interaction prompts to help children remember how to accomplish tasks [7,16]. (ages 2-11) 20. Consider using audio or visual cues for prompting instead of using textual prompts [7,10,22]. (ages 2-11) 21. Provide audio prompts with visual support because children do not pay attention to audio prompts alone [11,13,29]. (ages 2-7) 22. *Choose the wording of prompting interactions to be less technical and more “kid-friendly” to understand [22]. (ages 2-7) 23. *Be careful when using touchscreen terminologies such as select, pinch, and zoom for children’s interfaces [22,25]. (ages 2-7) 24. Provide animated prompts to help children learn what gestures to make, such as providing prompts for long-press gestures to help children remember to release their fingers after holding for a long time [16,22,30]. (ages 2-7) 25. *Keep essential audio, e.g., specific interaction suggestions, at the end of the sentence, not at the beginning [27]. (ages 2-7) 26. *Try utilizing time-outs after 3 to 5 seconds of inactivity to prompt children what to do next [27]. (ages 2-7)
	<b>Labels (L)</b>	27. Provide an option to have text labels (i.e., descriptions of on-screen objects and visual metaphors) read aloud [7,11,13]. (ages 2-7)
Application Responsiveness	<b>On-Touch Events (TE)</b>	28. Provide visual or audio feedback of accepted touch input; children benefit from larger, longer visual feedback [31]. (ages 2-11) 29. Use audio feedback to indicate accepted input to avoid distractions from unintended touches [7,13]. (no age specified)
	<b>Feedback Methods (FM)</b>	30. Provide auditory feedback such as an applause sounds or appreciation phrases during and after task completion [11,23]. (ages 2-7) 31. Provide effective scaffolding via positive feedback to motivate children, e.g., a character that encourages them [11,23]. (ages 2-7) 32. *Provide corrective feedback, such as pop-ups or dialogues offering feedback for correct and incorrect answers [4,11,14]. (ages 2-7) 33. Avoid heavy emphasis on extrinsic rewards such as points to not overshadow intrinsic learning motivation [11,23]. (ages 2-7) 34. *Provide feedback when app is busy processing so that children know to wait for something to happen [7,13]. (no age specified) 35. *Avoid using symbolic trackers like progress bars to track children’s progress, especially for ages 4 and under [17]. (ages 2-7) 36. *Create a visual illusion to help children map a symbol to its referent [17]. (ages 2-7) 37. *Use synchronous text highlighting for any text or story that is read aloud [11,27]. (ages 2-7)
Informational Features	<b>Tutorials (T)</b>	38. Avoid using in-app tutorials for children; the interface should provide some form of guidance during tasks [7,9]. (ages 7-11)
	<b>Instruction Format (IF)</b>	39. Provide an option to have text instructions read aloud [7,11]. (ages 2-7) 40. *Add a complementary visual component when using audio instructions such as an animation or highlight [27]. (ages 2-7) 41. *Avoid using abstract concepts in children’ instructions, e.g., referring to “left” and “right” portions of the screen [7,10]. (ages 2-7)
	<b>Advertisements (A)</b>	42. Avoid adding external web links or advertisements to the interface [11,19]. (ages 2-7)
<b>Physical</b>		
Gesture and Target Features	<b>Types of Gestures (TG)</b>	43. Avoid gestures such as flick, drag & drop, rotate, pinch and spread to interfaces made for children under age 4 [2,3,30]. (ages 2-7) 44. *Avoid adding the double tap gesture for children ages 5 and under, or allow a longer delay between the taps [22,27]. (ages 2-7) 45. *Support full-hand gestures for scrolling instead of thumb and index finger gestures, especially for ages 5 and under [12]. (ages 2-7) 46. Accept partial gesture completion as children have difficulty with finger-on-screen continuity while dragging [2,27,30]. (ages 2-11). 47. *Accept both single and multi-touch input for the same commands, e.g., using two or more fingers during a drag gesture should trigger the same effect as a single-finger drag gesture [30]. (ages 2-7) 48. *Accept tap times up to 5 seconds long and target offsets of 10 millimeters for children ages 2 and above [1,30]. (ages 2-11) 49. *Use horizontal scrolling instead of vertical scrolling, which is conceptually difficult for children [27]. (ages 2-7)
	<b>Gesture Family (GF)</b>	50. *Use consistent gestures throughout the app to avoid confusion [3]. (ages 2-7) 51. Use gestures to manipulate objects in children’s apps in a manner consistent with the object’s use in the real world [3]. (ages 2-7)
	<b>Target Size (TS)</b>	52. Increase the active area for interface widgets to allow slightly out-of-bounds touches to count [1,30,31]. (ages 2-11) 53. *Provide adequate space between two clickable items to compensate for children’s inaccuracy in targeting [3]. (ages 2-7)
<b>Socio-Emotional</b>		
Contextual Features	<b>Customization (C)</b>	54. Provide choice and customization features to enhance children’s intrinsic motivation and task engagement [9,15,26]. (ages 2-11)
	<b>Activity Structure (AS)</b>	55. Consider using an open-ended app structure to support children’s engagement and creativity [20]. (ages 2-11)
	<b>Social (S)</b>	56. Avoid computer-automated social interactions for children, as they have no effect on their engagement [8]. (ages 7-11) 57. *Provide an option for children to credit each other, rather than using automated means of acknowledgment [24]. (ages 7-11)

IDC2019 version of the evidence-based Touchscreen Interaction Design Recommendations for Children (TIDRC) framework. Design recommendations noted with asterisks were included in the framework after the empirical app analysis reported in this paper was already completed.

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