

Table 4. Design Principles

Principle	Description	Implementation
Learning Principles		
<i>Differential reinforcement of successive approximations</i> [70]2]	A skill is gradually shaped across successive trials by rewarding smaller segments of that behavior	Smoking cessation skills are broken down into smaller units, gradually presented and reinforced using game rewards
<i>Multiple Exemplar Training</i> [61]	Variations of a given concept or skill are deliberately used to increase learning generalizability	Multiple examples of smoking cessation concepts designed to increase the generalization of such skills to a variety of settings
<i>Positive Reinforcement</i> [70]2]	Consequences are presented to increase the frequency of a given behavior	Completion of app modules followed by gaming rewards to increase their frequency
<i>Fixed ratio of reinforcement</i> [70]2]	A reward is presented after a specified number of responses to produce a steady rate of responding	Completion of app modules followed by a fixed scheme of gaming rewards (e.g., 5 points after each module)
<i>Antecedent Control</i> [72]4]	Certain stimuli are presented to prompt an already established response	Use of app notifications and visual animations to trigger app behavior
<i>Negative Reinforcement</i> [70]2]	Consequences are removed to increase the frequency of a given behavior	Removal of app rewards if user does not complete certain modules or displays certain app behaviors
Design Principles to address SMI		
<i>Minimizing Cognitive Load</i> [30,38,39,41]6]	Minimizing the amount of semantic information to be processed by the user	Brief app content with minimal words and 6 th grade level sentences; predictable format and wireframes structure
<i>Maximizing Visual Acuity</i> [14]2]	Increase in discrimination of letters, numbers and symbols at a certain distance	Large typeface, numbers and icons to maximize visual processing and minimize touchscreen errors
<i>Flat Design</i> [73]6]	Minimalist use of stylistic elements, such as typography, and colors	Simple and consistent visual palette across wireframes and lack of dynamic screen elements (e.g., hiding menus)
<i>Minimal Layer Structure</i> [38]3]	Arrangement of app wireframes so that access to available content requires a minimal number of steps	Only 2 steps are required to access any available app content or features
<i>Storytelling</i>	The use of stories and interactive characters to convey concepts or encourage the use of skills	App content is embedded within an overarching narrative that includes characters and storytelling elements

