

# Development of the Mobile Educational Game “Tooth Stars” for Improving Children's Oral Health

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## **To the Editor,**

We are writing to inform dental practitioners and patients about the creation of the mobile educational game Tooth Stars, developed to improve oral health in children. This digital product was created as part of a doctoral dissertation focused on game-based approaches in dental health education, with an emphasis on modern digital technologies.

The use of games in children's education is well-known and has proven effective over the years. In today's world, mobile devices—smartphones, tablets, and laptops — are widely used by people, including children. This presents an opportunity to utilize these technologies for educational purposes. Thus emerged the concept of so-called “serious games”—“games designed to entertain players while educating, training, or changing their behavior” (2). Educational games are a type of serious game. The advantage of learning through electronic games lies in the learner's ability to choose the most convenient time of day to engage with the material. Games also allow for better adaptation to individual learning pace and cognitive capabilities. They represent a form of interactive teaching and are more illustrative than traditional methods (3), enabling continuous progress tracking and control through immediate feedback. Video games engage multiple senses, stimulate existing knowledge, provide real-time responses, and encourage active participation in solving problem-based situations (1). Studies have shown that games in education—especially serious games—can be at least as effective as traditional teaching methods, while providing a higher level of learner satisfaction and motivation (4).

The advantages of Game-Based Learning (GBL), the widespread use of mobile devices, and the lack of Bulgarian mobile educational games focused on oral hygiene and childhood nutrition motivated us to develop Tooth Stars and evaluate its effects in patients aged 5 to 9 years.

A team of computer specialists, an artist, and actors was assembled for the development of the game. Tooth Stars is available online and can be played directly in a web browser (at the following URL: <https://toothstars.itch.io/game>), without the need for installation. It was developed using Construct, a platform for creating 2D games.

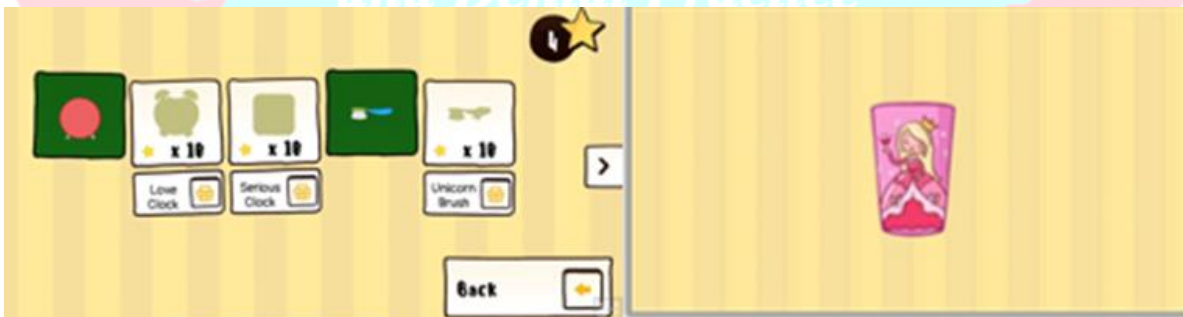
Tooth Stars provides training on the principles of maintaining good oral hygiene and encourages children to improve healthy habits, along with guidance for identifying healthy and cariogenic foods.

On the game's home screen, the child can choose a character to play with—either a boy or a girl. Then, they enter the main menu, where they must select one of three buttons: "Start Game", a virtual "Shop", or "Options".



**Figure 1: Home Screen and Main Menu of Tooth Stars**

When the first button is pressed, a game cycle begins. If the second button is selected, the character enters a virtual store where they can purchase various toys and toothbrushes. These items are "paid for" with stars earned during gameplay. The better the child performs and the more correct choices they make, the more stars they collect, which can then be used to unlock and obtain new rewards from the store. This serves as motivation for children to stay focused and do their best during the game. In the case of incorrect answers or poor task performance, stars are not deducted; instead, no stars are awarded. Taking stars away could have a negative psychological effect and discourage the child.

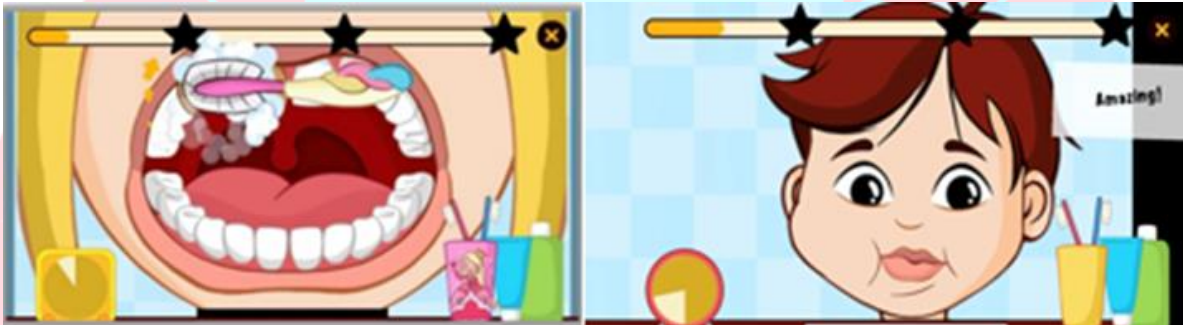


**Figure 2: Virtual Store**

When the "Options" button is selected, the character enters the game settings. Here, the child can change the character they play with, turn the music and sound effects on or off, and select the language for gameplay—Bulgarian or English. From the settings menu, they can also access their personal statistics, allowing them to see how many times the game has been played on that device, how long it was played, and how successfully the child performed.

The game "Tooth Stars" consists of four mini-games—two focused on oral hygiene and two on nutrition. In the first game, the child must "virtually" brush the teeth of the selected character using

circular motions to remove bacteria that appear sequentially on the teeth. The second mini-game is a bonus round where the player performs a "virtual" rinse and gargle after brushing, helping them earn more stars. The third game presents various foods and drinks, and the child must select those that are healthy for oral health by guiding them toward the character's mouth. In the fourth game, different foods fall from the top of the screen, and the child's chosen character must detect and avoid the foods that are harmful to oral health, preventing them from reaching the mouth.



**Figure 3: Elements from the mini-games for oral hygiene**



**Figure 4: Elements from the mini-games for nutrition**

The duration of one gameplay cycle is approximately 5 to 10 minutes, during which the child receives advice related to oral hygiene and nutrition. These tips are presented as spoken lines recorded by a voice actor, accompanied by text displayed on the screen. Each cycle of Tooth Stars includes a different set of tips, providing greater variety in order to maintain the child's interest over a longer period of time.



**Figure 5: Tip for oral hygiene**

A full cycle of the game represents a day in the child's daily routine—from waking up in the morning to going to bed at night. It begins with brushing the teeth in the morning and ends with brushing again before bedtime.

“The impact of using the game on children's knowledge, oral hygiene and dietary habits, as well as on their dental and oral hygiene status, will be presented in subsequent articles, allowing for precise and in-depth analysis.”

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