High intake of sugar-sweetened beverages and energy-dense foods, as well as low intake of healthy foods such as fruits, vegetables, and whole grains, has been linked to childhood obesity in the United States. School and after-school settings are promising locations to promote healthy nutrition to children, but barriers such as the need to expend resources for staff trainings and frequent staff turnover hamper successful implementation. Innovative approaches are needed to mitigate these barriers while providing educational fidelity, seamless implementation within the school day, and minimal teacher oversight. Educational video games may contribute to a solution. During the last decade, increasing research and application of serious games has demonstrated a positive impact on children’s cognitive development, dietary habits, and physical activity behavior. However, few evidence-based educational games are currently available for elementary school children.

The purpose of this article is to describe the theoretical foundation, function, and preliminary feasibility results of a new three-dimensional (3D) computer-based video game for nutrition education in children (8 to 12 years of age): The Quest to Lava Mountain (QTLM).

**Program Description and Feasibility**

QTLM is a theoretically grounded, 3D, immersive, web-based action-adventure video game for children age 8 to 12, developed by The Cooper Institute and the Texas Department of Agriculture to promote healthy eating behaviors among children. QTLM brings a unique approach to nutrition and gaming because it uses stealth learning to help participants understand how to optimize their health. QTLM players choose an avatar and complete quests to advance in the game, with approximately 10 hours of immersive game play. QTLM, not unlike The Legend of Zelda (Nintendo) and The Oregon Trail (Minnesota Educational Computing Consortium [MECC]), involves creative and critical thinking and challenges the child to learn new skills while reinforcing math, science, reading, history, environmentalism, social collaboration, and health. Controlled Chaos Media was selected to lead the development of QTLM because of the team’s experience with popular commercial games such as Brothers in Arms: Road to Hill 30 (Gearbox) and Call of Duty: Finest Hour (Spark Unlimited). For QTLM, nutrition content was incorporated into a well-storied game, featuring the same playability elements children are accustomed to seeing in consumer games. With the rapid expansion of web-based programs and gaming for educational and other behavior-change purposes, it is necessary for dietetics practitioners to be familiar with these programs and their acceptability/feasibility for school-based use.

QTLM helps children understand and apply five core concepts: (a) food is fuel; (b) food and physical activity are related; (c) healthy foods provide nutrients for optimal performance and stamina; (d) a healthy diet includes consuming a variety of healthy foods in moderation; (e) a physically active lifestyle helps to maintain optimal health. An additional integral concept in QTLM is sustainable food practices of eco-friendly farming, composting, recycling, and use of clean irrigation water.

QTLM game play is informed by Social Cognitive Theory and the Theory of Reasoned Action; the child is required to make appropriate food choices to progress and succeed in the game (Figure). Game methods (ie, active learning and practice, skill-building, problem-solving, and communication) and game strategies (ie, mazes, interactive activities, and simulations) are designed to impact determinants of dietary behavior: (a) knowledge about the health benefits of eating healthy foods such as fruits, vegetables, and whole-grain foods, and the detrimental effects of eating junk foods and sugar-sweetened beverages; (b) self-efficacy/perceived behavioral control for eating more servings of fruits, vegetables, and whole-grain foods; (c) subjective norms that eating fruits, vegetables, and whole grains every day and being physically active is the norm; (d) intentions to eat fruits, vegetables, and whole grains; and (e) change in behavior that results in increased consumption of servings of fruits, vegetables, and whole grains and decreased intake of sugar-sweetened beverages.

Players select avatars, traverse virtual environments (ie, the forest, caves, cliffs, a farm, and Lava Mountain), and complete quests. Foods are categorized based on nutrient density and caloric value using a color-coded, traffic light system based on the Coordinated Approach to Child Health (CATCH).
CONCLUSIONS

It seems that QTLM is one of first 3D nutrition education computer-based online video games targeting children (8 to 12 years). Research is required to determine the degree to which simulated game-based behaviors translate to real-world dietary and physical activity behaviors. The investigators are seeking funding to conduct a randomized controlled trial to determine the impact of QTLM on dietary behaviors in 3rd- to 5th-grade children. Serious video games such as QTLM can help mitigate implementation barriers in traditional school and after-school settings.

If efficacious in impacting dietary behaviors, video games may provide an appealing channel to disseminate and implement healthy dietary skills training in these settings. At this time, the Texas Department of Agriculture is providing all elementary schools in Texas with unlimited access to QTLM. The QTLM game trailer and further information can be viewed at The Cooper Institute’s website: www.nutrigram.org.

References


Figure. Logic model for The Quest to Lava Mountain nutrition skills-building game.

which is explained to participants before playing the game. Green (“GO” foods, eaten liberally, such as fruits and vegetables); yellow (“SLOW” foods, eaten moderately, such as 2% milk, peanut butter); and red (“WHOA” foods, consumed only occasionally, such as soda). Foods available in the game are from ethnically diverse diets (eg, tortillas, breakfast tacos, stir fry, pork chops, catfish). Gathering, cooking, and consuming healthy foods positively impacts avatar health and enables quest success. Game success is measured by completing quests; gathering and cooking different foods; and acquiring coin rewards, new recipes, and game skills.

In prototype feasibility testing, a convenience sample of 19 Dallas/Ft Worth, TX-area elementary school students (mean age 9.2 years; 84% male; and 50% white, 25% Hispanic, and 15% Asian) who were experienced with video game–playing rated QTLM as optimally challenging (60%) with an engaging story (66%), having intuitive game dynamics (building/exploring/combat) (63% to 79%), and enjoyable controls, music, and sounds (55% to 80%). Most raters reported that QTLM goals were acceptably clear (67%), although ratings for ease of use for specific functions were varied (40% to 89%). Most rated QTLM sufficiently likable and fun without being overtly “educational” (87%). Qualitative feedback from structured interviews with the children found that QTLM was “really cool,” “directions were good,” “would recommend to friends,” “would play again,” and “that it taught them to eat better food instead of ‘junk’ food.” Other feedback included that students felt that the “bugs” or “bosses” were too difficult to beat, and that the map was not explicit enough. Based on this feedback, changes were made to the game. The project was approved through The Cooper Institute’s Institutional Review Board.
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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

FUNDING/SUPPORT

The Quest to Lava Mountain computer video game was developed in 2011 through a partnership between The Cooper Institute and the Texas Department of Agriculture. This was part of the educational requirement of the US Department of Agriculture (USDA) grant to develop NutriGram, a nutrition assessment and education service.

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ACKNOWLEDGEMENTS

The authors acknowledge the Texas Department of Agriculture (Food and Nutrition Division), specifically Amanda Hovis, MPH, who made substantial contributions to the content development of The Quest to Lava Mountain, as well as The Guildhall at Southern Methodist University, Ron Jenkins, director of external affairs, and Controlled Chaos Media founder and chief executive officer Hunter Woodlee.