

Enhancing Health Education Through AI-enabled Game

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Introduction

Mobile health games are emerging as innovative tools for promoting healthy behaviors, particularly among children. Fooya, a mobile game designed to encourage healthy eating habits, has shown promise in influencing nutritional choices through engaging gameplay that incorporates neurocognitive training and habit formation [1 - 3]. By analyzing the gameplay telemetry data, gameplay patterns can inform game design, enhance personalized learning experiences, and potentially link in-game behaviors to real-world health improvements.

Methods

Data Collection

- The dataset was collected from an 11-week randomized controlled trial (RCT) involving 240 children from Grades 1-8 at a government school in Chennai, India [3].
- Participants were divided into two groups: the Treatment group played the Fooya game, while the Control group played a non-health educational game for 30 minutes weekly.

Statistical Analysis for Real-World Outcomes

- The correlation between identified gameplay patterns and learning outcomes (test scores) was assessed using statistical tests, aiming to link in-game success to changes in nutritional knowledge over time.

Markov Chain Analysis

- Markov chains were used to model player behavior sequences, capturing the probabilities of transitioning from one in-game action to another. This helped visualize the most common pathways players followed, with nodes representing game actions and edges indicating the probability of transitioning to the next action.

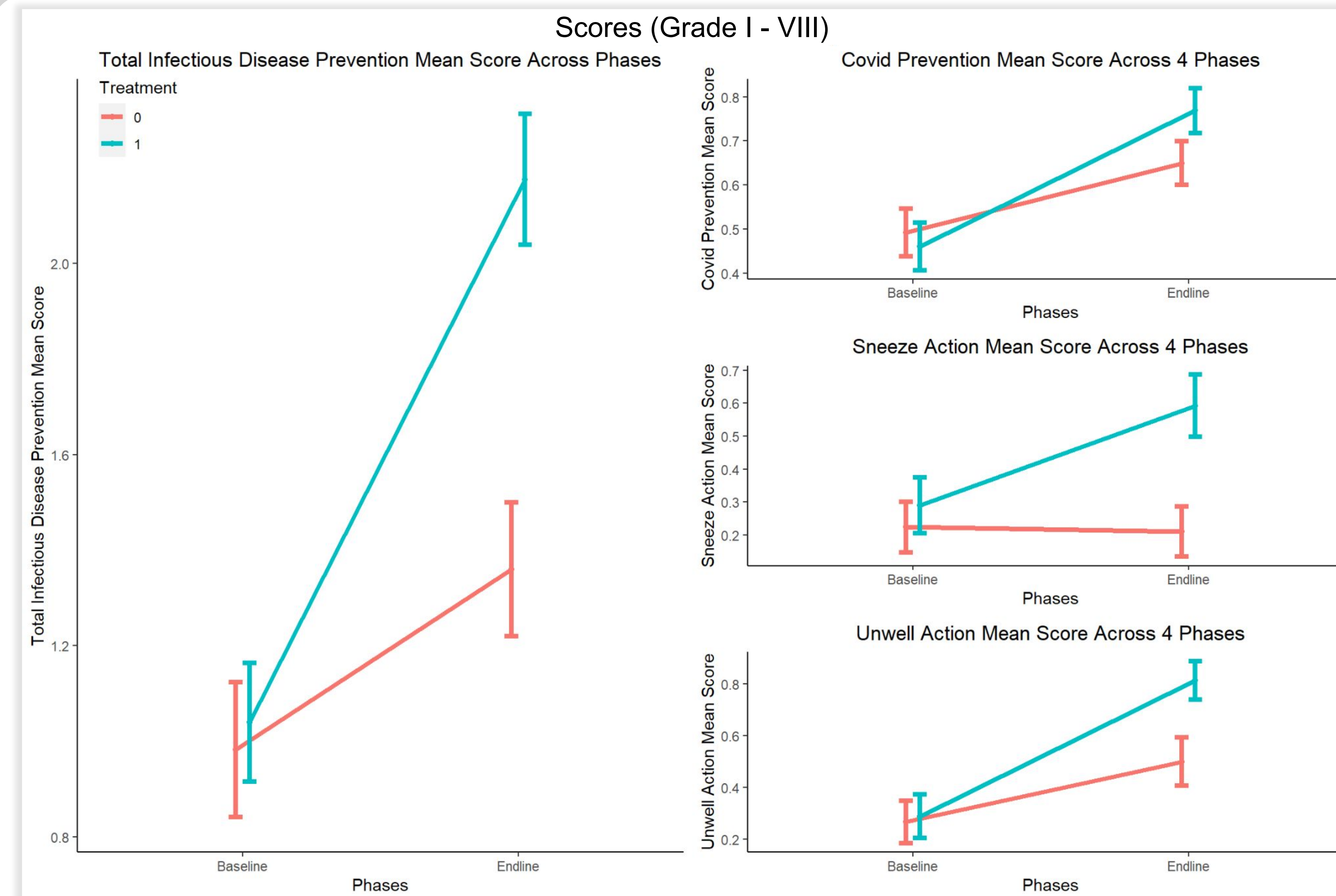


Figure 1. This shows average scores (with 95% CI) of all students in treatment (Grade I, IV, VI, VII) and control (Grade II, III, V, VIII) grades based on child surveys conducted at baseline (Month 0) and endline (Month 3).

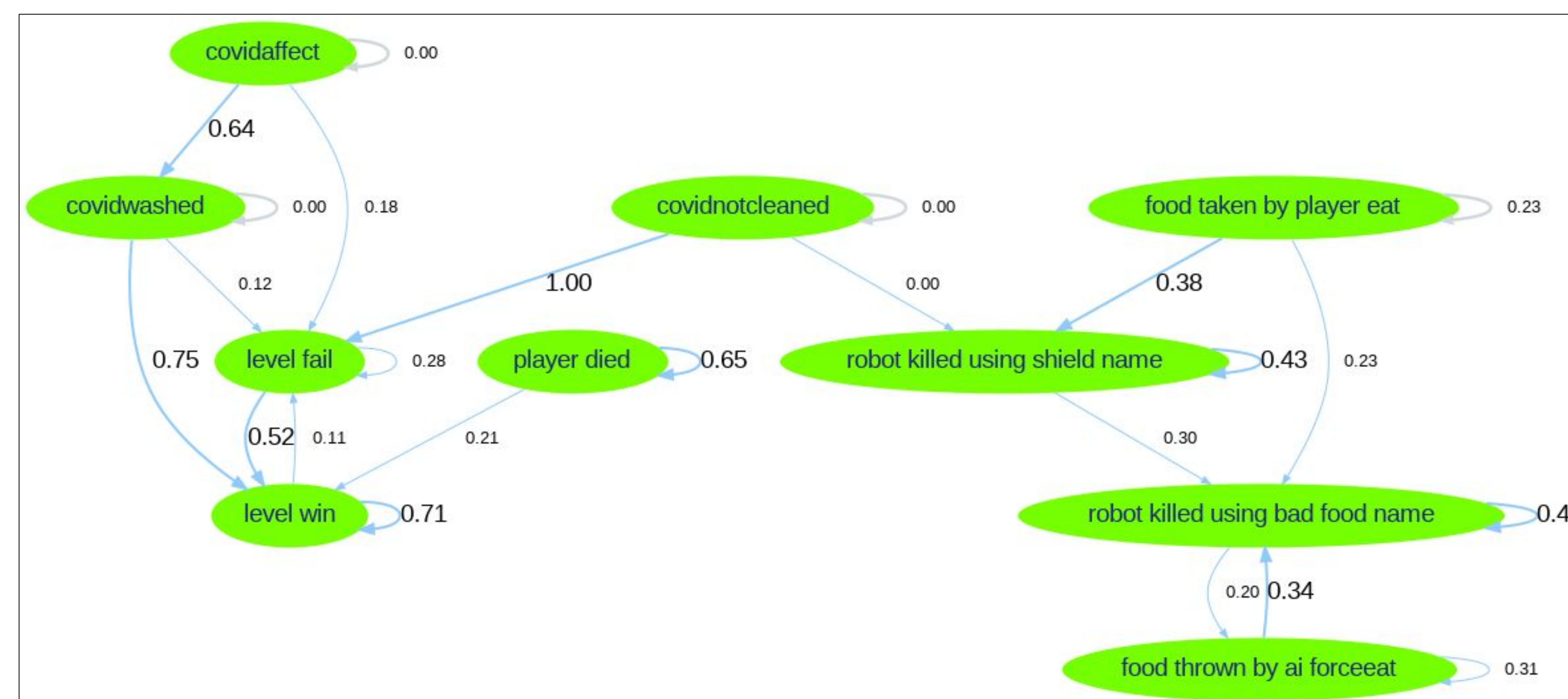


Figure 2. Markov Chain Visualization of Player Actions in Week 1 (Grade VII). Each node corresponds to a specific in-game action, while the edges denote the probability of transitioning from one action to another. This is a preliminary analysis that aggregates results across all Grade VII students, providing an overall snapshot of player behavior patterns.

Research Questions (RQs)

1. What impact does the intervention have on players' learning outcomes as measured before and after the intervention?
2. What are the key gameplay patterns among different players?

Future Directions

- Refined by improving Markov chain modeling
- Additional techniques like sequence mining to uncover frequent action sequences, while association rule mining to identify key combinations influencing win rates.
- Clustering methods will be used to group players by similar strategies
- Future RCTs may incorporate wearables to track physical activity, allowing for a comprehensive evaluation of game-based interventions and real-world health impacts.

Conclusion

The results indicate that Fooya, a mobile game which integrates implicit learning into its gameplay mechanics, can have a positive effect on children's health-related knowledge and behaviors as seen in Fig. 1. Furthermore, the preliminary analysis in Fig. 2, using Markov chains, reveals key gameplay patterns among students, particularly in handling critical tasks like cleanliness. The analysis is aggregated and does not account for individual differences. Future work will employ advanced techniques to uncover deeper insights and allow for personalized gameplay strategies.

References

- [1] R. Padman et al., "Mobile Game-Based Digital Vaccine for Reducing Risk of Lifestyle Diseases," *Iproceedings*, vol. 4, no. 2, p. e11790, Sep. 2018, doi: 10.2196/11790.
- [2] Y.-C. Kato-Lin et al., "Impact of Pediatric Mobile Game Play on Healthy Eating Behavior: Randomized Controlled Trial," *JMIR MHealth UHealth*, vol. 8, no. 11, p. e15717, Nov. 2020, doi: 10.2196/15717.
- [3] R. Padman, J.-H. Chin, A. Gupta, and R. Ladhania, "Examining Gameplay Patterns and their Association with Nutritional Knowledge," in *2024 IEEE Conference on Games (CoG)*, Aug. 2024, pp. 1-4. doi: 10.1109/CoG60054.2024.10645572.