International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:11, Issue:05 "May 2026"

Adaptive Health Chatbots for Teaching Personalized Health Concepts: A Study of Mety

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DOI: 10.46609/IJSSER.2026.v11i05.035 URL: https://doi.org/10.46609/IJSSER.2026.v11i05.035

Received: 24 April 2025 / Accepted: 18 May 2026 / Published: 30 May 2026

ABSTRACT

This research examines and evaluates the effectiveness of an adaptive digital health chatbot (METY) designed to ***teach general-health concepts*** *through personalized, interactive dialogue, compared to a standard non-adaptive chatbot. Using a structured knowledge-assessment framework (facts, strategies, procedures, and rationales), METY helps users understand health topics such as nutrition, physical activity, sleep, hydration, and illness prevention. The instructional material defines general health as 'the holistic state of a person's physical, mental, and social wellbeing. The system emphasizes conceptual learning and comprehension tailored to individual contexts rather than prescribing actions or medical advice (Centers for Disease Control and Prevention, 2023; National Institutes of Health, 2022).*

Twenty-eight participants from diverse backgrounds completed parallel questionaries-one using adaptive chatbot (METY) and another using a standard chatbot. Results indicate that METY significantly improved user comprehension (M =25.65 vs. 21.33), t (26) = 2.90, p = .0075. Qualitative feedback highlighted METY's clarity, usability, and ability to simplify complex concepts. Findings suggest adaptive chatbots can enhance literacy, engagement, and conceptual understanding (Denecke & Bamidis, 2021).

1. INTRODUCTION

Traditional health chatbots often focus on delivering recommendations; however, users frequently lack the foundational understanding needed to apply these suggestions effectively *(Krebs & Duncan, 2015).* METY addresses this gap by functioning as a teaching-oriented health companion, guiding users to understand why certain health behaviors matter rather than simply telling them what to do. By emphasizing conceptual learning, METY supports the development of health literacy, enabling users to make informed decisions independently. METY was

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designed to address this gap by functioning as an **adaptive teaching tool** that helps users understand health concepts through interactive questioning, personalized explanations, and iterative clarification.

The instructional materials emphasize that general health depends on integrated behaviors such as "diet, physical activity, sleep, hydration, and hygiene" *(Centers for Disease Control and Prevention, 2023; National Institutes of Health, 2022)*. METY teaches these concepts by breaking them down into understandable components and adjusting explanations based on user input. Unlike traditional chatbots, METY does not simply provide answers—it guides users through the reasoning behind health concepts, supporting long-term understanding *(Fleming & Mills, 1992).*

2. BACKGROUND AND FRAMEWORK

What AI-CHATBOTS Must Know to teach Health Concepts

To teach effectively, METY gathers user information not to prescribe actions, but to adapt personalized explanations of health concepts to the learner's context.

2.1 Demographic and Biological Data

- Age, gender, ethnicity
- Allergies, chronic diseases, past medical conditions
- Vaccination status
- Family history (when relevant)

2.2 Behavioral and Lifestyle Data

- Food choices and dietary restrictions
- Sleep duration and sleep-hygiene patterns
- Physical activity level
- Water intake and hydration habits
- Mood and stress indicators

METY tailor examples and analogies that make concepts easier to understand *(American College of Sports Medicine, 2021; Hale & Guan, 2015).*

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2.3 User Goals

- Weight management
- Disease prevention
- Improved fitness
- Better sleep
- Stress reduction

METY uses these goals to focus teaching on the most relevant topics.

2.4 Adaptive Chatbot Design includes:

- Collecting user data to personalize explanations
- Offering alternative examples when users express confusion
- Adjusting explanations based on feedback
- Using negotiation-based preferences to refine teaching
- Tracking progress to reinforce learning *(Fogg, 2009)*

Key system features METY integrates:

- Persistent user profiles (Flask + SQL backend)
- Adaptive coaching style learning
- Iterative refinement of recommendations

3. METHOD AND STRATEGIES

How METY Teaches Health Concepts

3.1 Holistic Health Integration

METY explains how nutrition, exercise, sleep, hydration, and illness prevention interact, mirroring the instructional material's integrated model *(Centers for Disease Control and Prevention, 2023; National Institutes of Health, 2022)*.

3.2 Personalization Through Example Matching

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- Uses examples based on user preferences
- Explains why certain nutrients matter *(American College of Sports Medicine, 2021)*
- Teaches how sleep routines affect circadian rhythms
- Describes hydration needs using personalized analogies

3.3 Safety-Centered Adaptation: METY avoids teaching with examples that conflict with allergies or medical conditions.

3.4 Long-Conceptual Understanding: METY focuses on why health behaviors matter, supporting long-term comprehension rather than short-term actions *(Fogg, 2009)*.

Participants: Twenty-eight individuals representing diverse ages, ethnicities, and backgrounds were included in the study. Participants completed two assessments consisting of 27 questions under each category designed to evaluate their understanding of general health concepts. Both systems, METY chatbot interaction and standard chatbot, interaction generated health concept responses based on identical prompts.

Materials: The Instructional general health concept document was provided to all participants. Two Google Forms featuring the same assessment questions were developed, each connected to a separate chatbot-METY and the standard chatbot to allow for direct comparison. https://forms.gle/mkCaD7C5gqH3tDJt8 : Adaptive Chatbot Questionnaire

https://forms.gle/yJ3iHSprtU8Uix7a9: Standard Chabot Questionnaire

4. PROCEDURES: Participants were first assigned to a specific chatbot they would use during the study. Following the assignment, all participants were provided with reading instructional material, how to interact with their assigned chatbot, and the expectations for completing the activity.

After reviewing the instructions, participants engaged in an interactive session with their assigned chatbot. During this phase, they completed the designated tasks through guided conversation. Participants in the METY chat bot condition completed a structured self-assessment as part of their interaction, allowing them to reflect on their responses and receive feedback within the chatbot environment. Upon completing the chatbot interaction, all participants proceeded to a post-test designed to measure outcomes related to health concepts. This post-test was administered uniformly across all conditions to ensure consistency in data collection.

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METY's Self-Assessment Process – Within the METY adaptive chatbot, participants engaged in a guided self-assessment designed to convert adaptive teaching into conceptual understanding. This process was embedded directly into the chatbot interaction and followed a structured, iterative framework grounded in four knowledge categories: facts, strategies, procedures, and rationales. Accordingly, students are asked to input their subject matter knowledge of fact, strategies, procedures, and rationales and where their perceived gaps are. This information is used by METY to help students fill in those knowledge gaps rather than giving standard answers to questions as LLMs typically do.

4.1 Step 1 — Intake and Contextualization

METY begins by asking structured questions about:

- Structured intake questions collect demographic, biological, behavioral, and goal data (age, allergies, sleep patterns, activity, hydration, goals).
- Context matching: METY uses intake answers to select examples and analogies that match the user's lifestyle and goals, so the self-assessment items are personally relevant.
- Timepoint tagging: Each assessment is time-stamped and linked to the user profile so progress over repeated sessions can be tracked.

4.2 Step 2 — Self-assessment and Response Generation

- Automated scoring: Objective items are auto-scored; open responses are scored by rubric (keyword/logic matching) and by the LLM for conceptual completeness.
- Immediate feedback: For each item, the user receives (a) a correctness indicator, (b) a concise explanation tied to the instructional taxonomy (fact/strategy/procedure/rationale), and (c) one targeted follow-up question or micro-exercise.
- Reflection prompts: After each domain, METY asks the user to rate confidence and to write one short action they will try; these self-ratings are stored and used to weight future item selection. *(National Institutes of Health, 2022).*

4.3 Step 3 — Adaptive feedback and Self-Correction

METY generates structured teaching responses that include:

- Clarified explanations of misunderstood concepts & additional examples tailored to user context. For instance- Nutrition concepts: aerobic + strength training *(American College of Sports Medicine, 2021)*

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- The system generates 1–3 short, scaffolded learning activities prioritized by the largest gaps and the user's stated goals. For example-Sleep hygiene concepts *(Hale & Guan, 2015; National Institutes of Health, 2022)*
- Mety compares their initial and improved understanding and reflects on how their thinking evolved.

4.4 Step 4 — Data Handling, Safety, and Ethics

- Privacy by design: Assessment data are stored in the user's persistent profile (Flask + SQL) and linked only to the user account; sensitive items (allergies, chronic conditions) are flagged so METY avoids unsafe examples.
- Feedback is educational and conceptual; METY explicitly avoids giving prescriptive medical advice and prompts users to consult professionals when clinical decisions are needed. User alternative examples (Fleming & Mills, 1992)

This adaptive loop makes METY a "learning companion," not a perspective tool. Participants also interacted with a standard chatbot to respond to the same set of questions, after which their scores and qualitative feedback were recorded.

5. RATIONALES: Why Adaptive Teaching Matters

5.1 Increased Learning Effectiveness: Personalized explanations improve comprehension because they match the learner's background and interests *(Fleming & Mills, 1992)*.

5.2 Safety and Accuracy: Customization prevents misunderstandings related to allergies, medical conditions, or inappropriate examples.

5.3 Support for Long-Term Learning: Behavioral science shows that people retain information better when it is relevant and tailored *(Fogg, 2009)*.

5.4 Alignment with Holistic Health Principles: The instructional material emphasizes coordinated biological processes; METY teaches these connections clearly and in accessible manner *(Centers for Disease Control and Prevention, 2023)*.

6. RESULTS

Participants' responses to the post-test questions were scored. Participants who used the METY adaptive health-concept assessment chatbot achieved a mean score of 25.65, whereas those who used the standard chatbot scored a lower mean of 21.33. A paired-samples t-test confirmed that

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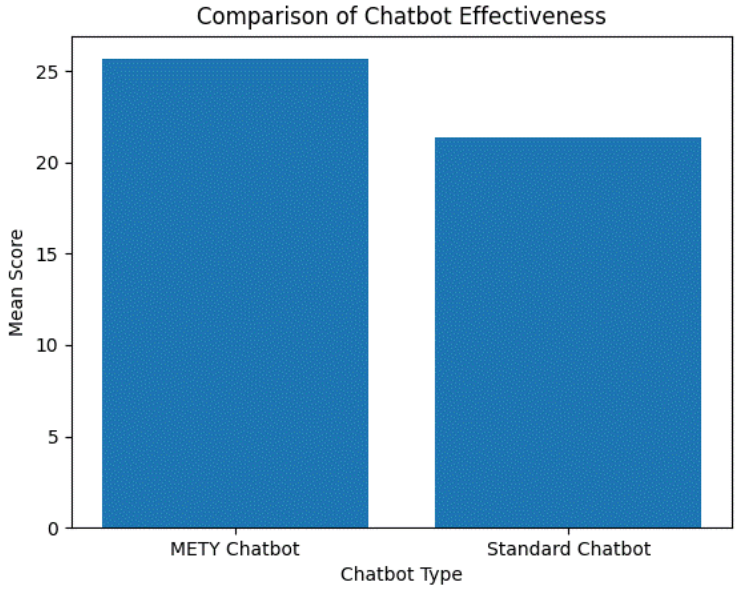
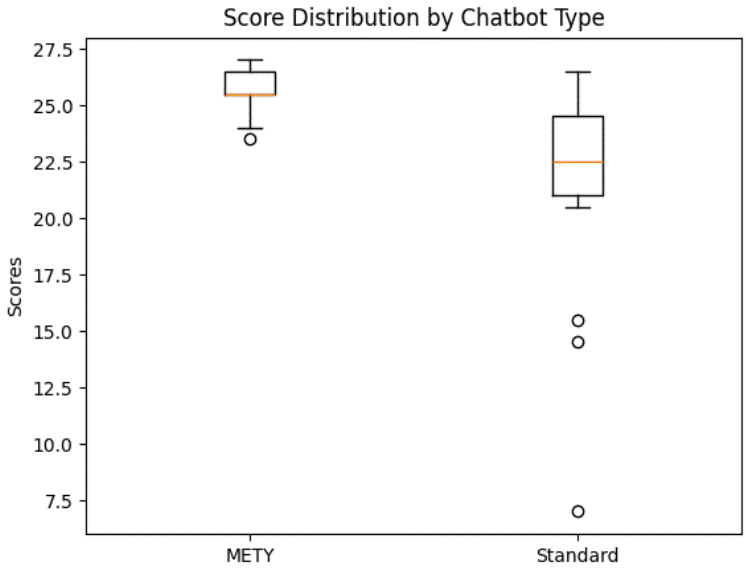
this difference was statistically significant, $t\ (26) = 2.90$, $p = .0075$. This indicates stronger comprehension and retention of general-health concepts.

These results demonstrate that METY significantly improves users' **understanding and retention of general-health concepts**, rather than simply influencing behavior through recommendations.





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Qualitative feedback further reinforced the quantitative results. Participants consistently described METY as “easy to use,” “clear,” and “helpful in clarifying complex concepts like homeostasis and systemic resilience.” Users emphasized that METY “made learning interesting and easy to remember,” highlighting its ability to simplify advanced health concepts (*Denecke & Bamidis, 2021).*

In contrast, the standard chatbot was described as unclear, confusing, and less helpful for learning.

7. DISCUSSION

METY functions as an adaptive **educational health companion**, emphasizing the development of health literacy through personalized teaching. By structuring responses into facts, strategies, procedures, and rationales, the system helps users build a deeper understanding of health concepts. This approach moves beyond traditional recommendation-based systems and instead empowers users to make informed decisions independently (*Denecke & Bamidis, 2021)*.

A key distinction of METY is that it does not replace professional medical advice or prescribe fixed actions. Instead, it **supports learning**, enabling users to explore health topics, ask individualized questions, and receive explanations tailored to their context. This educational approach reduces the risk of misuse and promotes long-term understanding rather than short-term compliance.

REFERENCES

American College of Sports Medicine. (2021). *ACSM’s guidelines for exercise testing and prescription* (11th ed.). Wolters Kluwer.

Centers for Disease Control and Prevention. (2023). *Physical activity guidelines for Americans.* U.S. Department of Health & Human Services. https://www.cdc.gov/physicalactivity

Denecke, K., & Bamidis, P. (2021). Artificial intelligence for health: A review of chatbots for health care. *Frontiers in Artificial Intelligence, 4,* Article 630407. https://doi.org/10.3389/frai.2021.630407

Fleming, N., & Mills, C. (1992). Not another inventory, rather a catalyst for reflection. *To Improve the Academy, 11*, 137–155.

Fogg, B. J. (2009). A behavior model for persuasive design. Proceedings of the 4th International Conference on Persuasive Technology, 1–7. https://doi.org/10.1145/1541948.1541999

ISSN: 2455-8834

Volume:11, Issue:05 "May 2026"

Hale, T., & Guan, H. (2015). Screen time and sleep among school-aged children and adolescents: A systematic literature review. Sleep Medicine Reviews, 21, 50–58. https://doi.org/10.1016/j.smrv.2014.07.007

Krebs, P., & Duncan, D. T. (2015). Health app use among US mobile phone owners: A national survey. *JMIR mHealth and uHealth, 3*(4), e101. https://doi.org/10.2196/mhealth.4924

National Institutes of Health. (2022). *Healthy sleep: Understanding sleep hygiene.* U.S. Department of Health & Human Services. https://www.nih.gov

