Executive Summary

A Social Robot as a Health Educator for Heart Failure Patients Using the Teach-Back Method

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IT899XA: Master's Project in Instructional Design and Technology

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May 2, 2026

Executive Summary

Heart failure (HF) is one of the most prevalent chronic conditions in adults aged 65 and older and is the leading cause of hospitalization among the Medicare population. It is associated with significant healthcare expenditures due to preventable hospital readmissions (Malik et al., 2021; McIlvennan et al., 2015). Effective HF management requires patients to understand their condition and engage in complex self-care behaviors (Heidenreich et al., 2022; Stahlman et al., 2023). Often, patients leave brief clinical encounters without a clear understanding of HF, self-care, or signs and symptoms of a worsening condition. Time constraints, clinical priorities, and varying levels of patient health literacy limit healthcare providers' ability to deliver comprehensive HF education. This knowledge gap contributes to poor self-management, preventable readmissions, and undue strain on healthcare systems. This project explored the use of the Furhat social robot as a patient health educator in HF using the teach-back method. Using the ADDIE instructional design model, I designed, developed, implemented, and evaluated a robot-mediated educational intervention. The intervention incorporated the teach-back method, requiring learners to explain in their own words the information provided to them and allowing health educators to provide immediate feedback (Yen & Leasure, 2019).

The analysis phase focused on the client context, target learners, HF knowledge, and self-care skills needed for effective HF management. The clients were family physicians practicing in a primary care clinic in rural Southeast Kansas. The target learner population was adults living in the same rural area who were within the age group commonly affected by HF. Findings indicated that patients must understand core HF concepts and apply them to daily decision-making related to medication adherence, dietary restrictions, symptom monitoring, and when to seek medical attention. Traditional clinical environments do not provide enough time or formal structure to

ensure patient comprehension. Based on these findings, an instructional module was developed using the Furhat platform. Sheila was created to deliver HF education in a reliable, consistent manner. The HF instructional content was chunked into focused segments and aligned with key HF knowledge and self-care behaviors. The robot employed the teach-back method during the educational intervention. Eleven volunteers participated in the pilot implementation. The participants took a pre-test to assess their baseline knowledge, engaged in the robot-mediated instructional session, completed a post-test, and participated in an exit interview. Sessions averaged approximately 35 minutes and varied based on participant need for reinforcement. Evaluation findings indicated that most participants showed short-term improvement in HF knowledge, with mean scores increasing from 15.9 to 18.3. Qualitative feedback revealed that participants found the interaction to be clear, engaging, informative, and enjoyable. Participants reported increased comfort after a few conversational turns. Concerns related to this novel robotic technology being perceived as uncanny did not appear to interfere with learning. Feedback identified areas for improvement, including increased response time, flexible conversational abilities, and more detailed robot feedback. These findings informed revisions of the prototype and emphasized the importance of aligning instructional design with current technological capabilities.

This project contributes to a greater understanding of the role of social robots in patient education. While the pilot results are encouraging, more research is needed to determine whether short-term gains in understanding translate into long-term learning and improved adherence. Future iterations may require more advanced generative AI technologies to support greater interactivity and natural dialogue while ensuring strong safeguards for patient safety and informational accuracy. Through continued refinement, this approach may serve as an invaluable

tool to complement traditional patient education by streamlining healthcare provider workflow and improving HF patient outcomes.

References

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IMPACT

Social robots have the potential to enhance patient education by providing:

- **Consistent and structured instruction**
- **Increased patient engagement**
- **Opportunities for active participation**
- **Support for healthcare providers**

Looking Ahead

Future development may include:

- **More natural conversational interaction**
- **Improved response recognition**
- **Integration of advanced AI technologies**
- **Exploration of long-term learning outcomes**

ADDIE DESIGN MODEL

This project was developed using the ADDIE instructional design model to guide a structured, learner-centered approach.

Analysis

Identified gaps in patient understanding of HF and self-care

Design

Developed a structured teach-back interaction to support active learning

Development

Created an instructional experience using the Furhat social robot platform

Implementation

Conducted a pilot session with participants in a controlled clinical setting

Evaluation

Assessed learning outcomes and participant experience to guide improvements

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May 15, 2026

The Problem

Heart Failure Patient Education

Heart Failure (HF) is one of the leading causes of hospitalization among adults aged 65 and older. Effective management depends on patients' ability to understand their condition and consistently perform complex self-care behaviors.

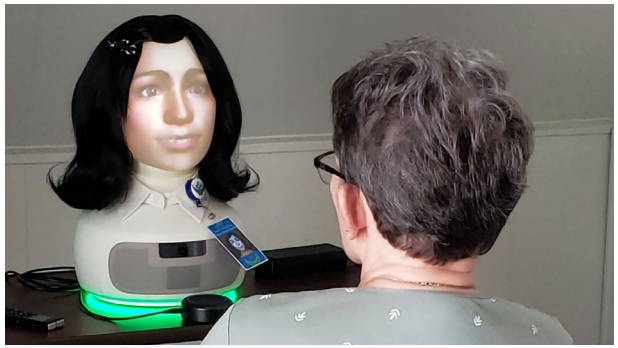
Unfortunately, many patients leave clinical encounters without a clear understanding of their condition or how to manage it.

Key Challenges

- **Limited time for patient education**
- **Complex self-care requirements**
- **Varying levels of health literacy**
- **Limited opportunities to verify understanding**

Why This Matters

Without a clear understanding of their condition, patients are at increased risk for poor self-management and preventable hospital readmissions.



Participant interacting with Sheila during HF education session

The Proposed Solution

Meet Sheila

Sheila is a social robot designed to deliver HF education using the teach-back method. Sheila guides patients through key concepts and encourages them to explain what they have learned in their own words, allowing for immediate feedback and reinforcement.

How It Works:

1. **Explains key HF concepts**
2. **Patient responds in own words**
3. **Provides immediate feedback**

Advantages

- **Interactive**
- **Consistent**
- **Patient-centered**

Knowledge Improved

HF Test Score Increases

15.9 (pre-test) → 18.3 (post-test)

Participant Feedback

- **Clear and easy to understand**
- **Engaging and informative**
- **Comfortable and natural**

Opportunities for Improvement

- **Increased response time**
- **More flexible conversation**
- **More detailed robot feedback**

Participant smiling during interaction with Sheila, demonstrating engagement and comfort during the instructional experience