

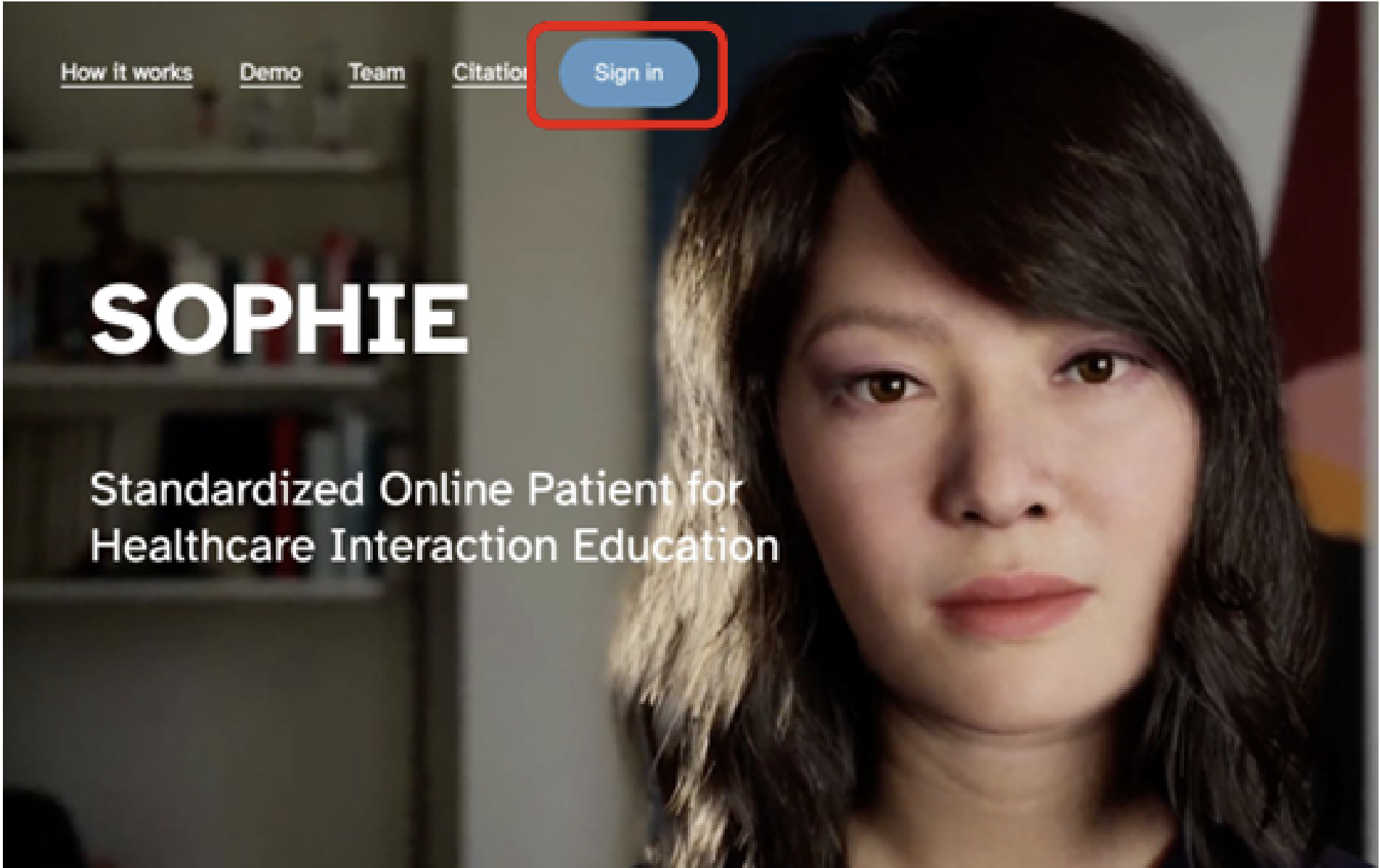
Large Language Model–Based SOPHIE Virtual Simulations for Communication Training in Dental Residents: A Pilot Study



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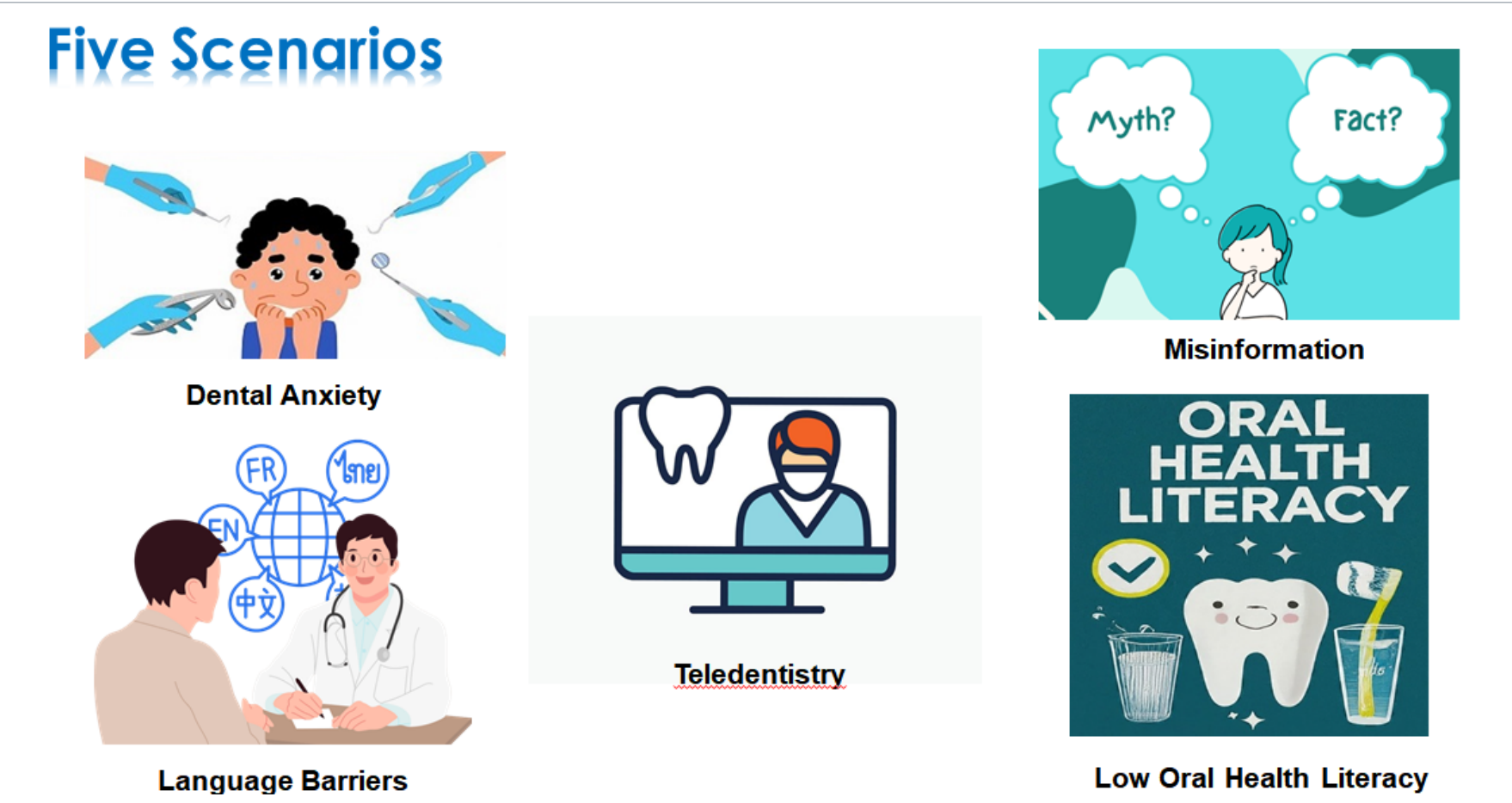
INTRODUCTION



Prenatal dental care often presents communication challenges, including maternal anxiety, language barriers, oral health illiteracy, radiation safety concerns, and access via teledentistry. Training dental residents to address these issues is critical for culturally competent and patient-centered care. This pilot study assessed the feasibility of using large language model (LLM)–based SOPHIE virtual patient simulations to enhance communication training among multicultural dental residents at the Eastman Institute for Oral Health (EIOH)

METHODS

Five LLM-driven virtual models were created to simulate prenatal care scenarios reflecting common challenges. Residents engaged with each scenario in structured sessions, Collected pre and post SE-12 surveys; practicing communication strategies and receiving facilitated feedback by the LLM model on four habit model as well as focus on entire transcript indicating the empathy and empowerment in their communications.



RESULTS

Residents’ self-efficacy scores improved from a baseline to a post-intervention. This trend was consistent with qualitative reflections: residents described becoming more deliberate in pausing, listening, and using open-ended questions. Several noted greater awareness of avoiding jargon and structuring conversations more clearly. Despite usability concerns, participants consistently highlighted the educational benefits of SOPHIE. Feedback tools such as transcripts, empathy markers, and jargon tracking were particularly valued. Non-native English-speaking dental residents found the system especially helpful in learning to replace technical terms with patient-friendly language. This suggests that even if usability is rated only moderate, the system provides meaningful training value and fosters reflection on communication practices.

Actionable Feedback

(AI Generated feedback may be inaccurate)

What You Did Well

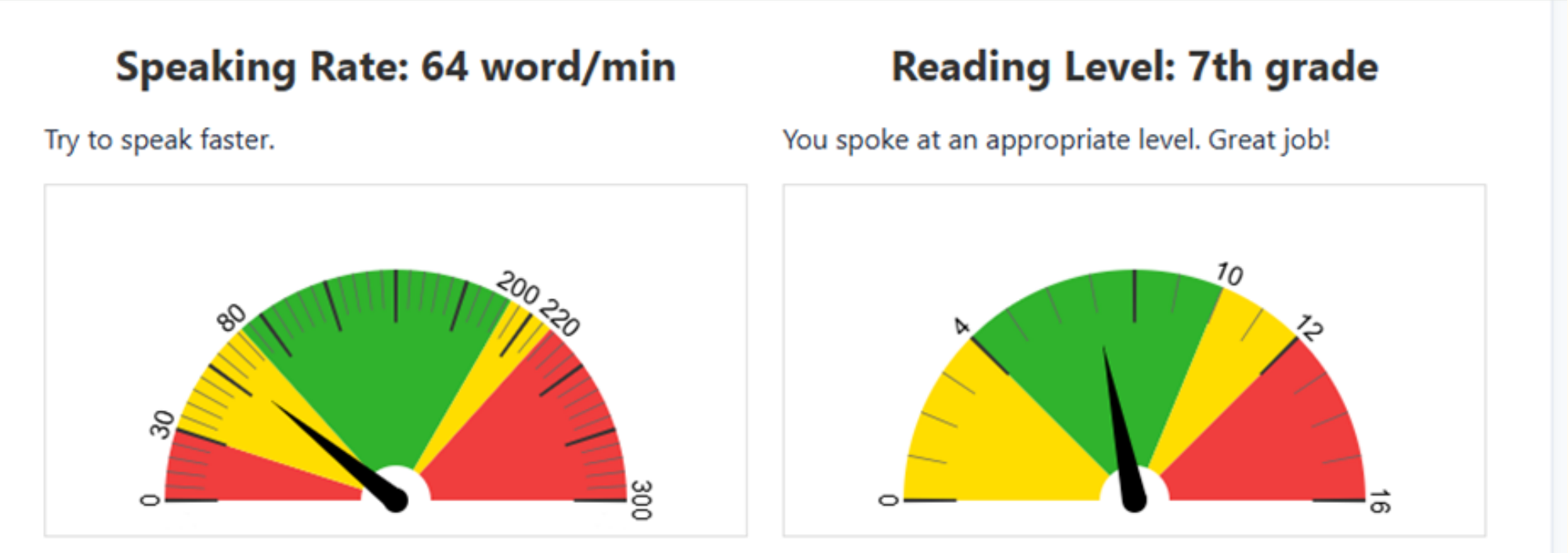
- Created rapport quickly:** You greeted Danielle warmly and acknowledged her nerves (“No worries today helped set a supportive tone (*Invest in the Beginning*)).
- Used open-ended questions:** You asked Danielle to tell you why she came in, which encouraged her to her concerns (“Could you first tell me...?”).
- Validated her emotions:** You expressed empathy after hearing about her past negative dental experience. I’m so sorry to hear that... I’ll be good taking care of you, OK?”. This supports *Demonstrate Empathy*.
- Addressed pregnancy-specific concerns:** You reassured her about safety (“We are the perinatal clinic. have special technique and skills...”).
- Allowed patient to guide the conversation:** You responded to Danielle’s questions and fears as they are letting her share information at her pace (*Elicit the Patient’s Perspective*).

Areas to Improve

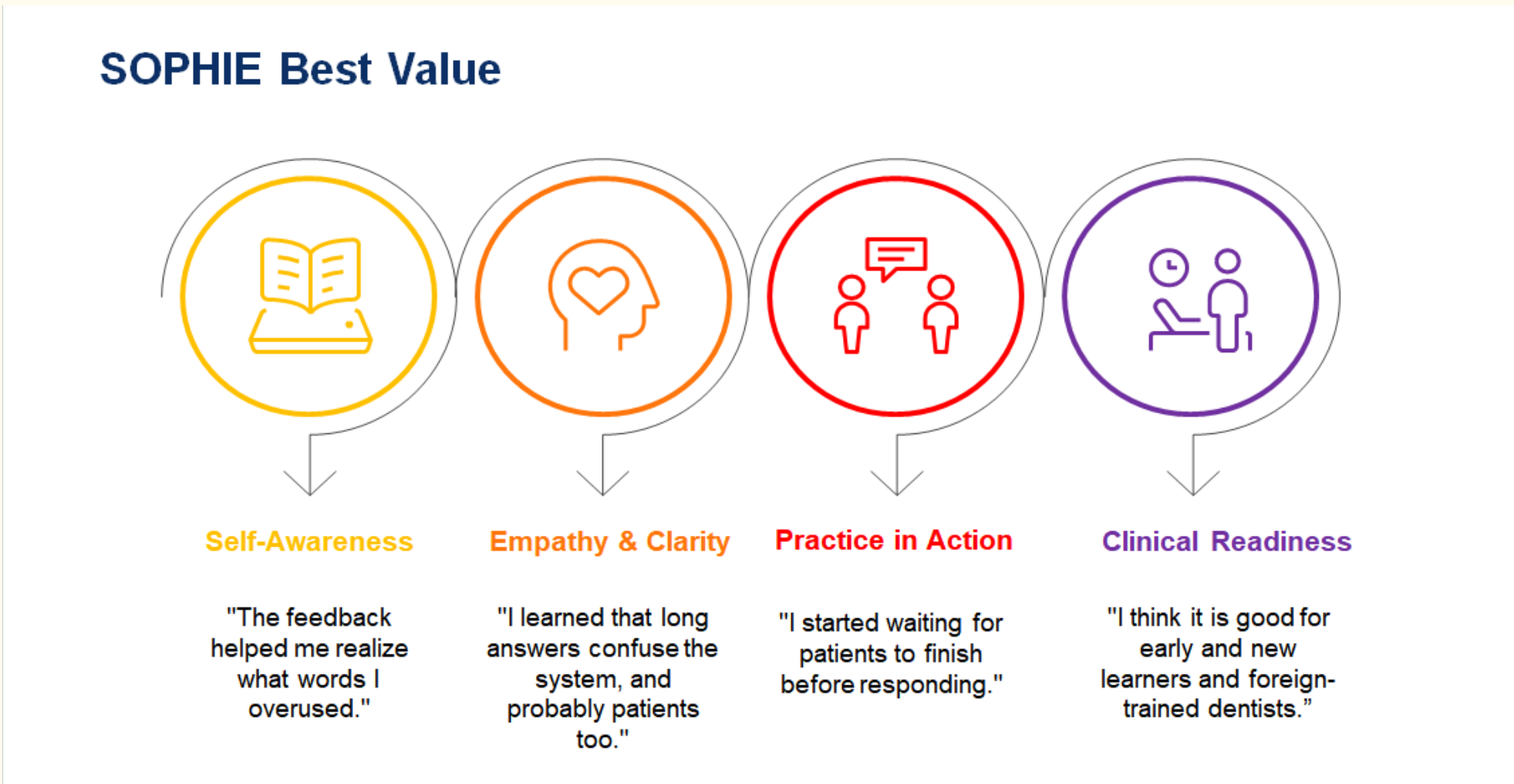
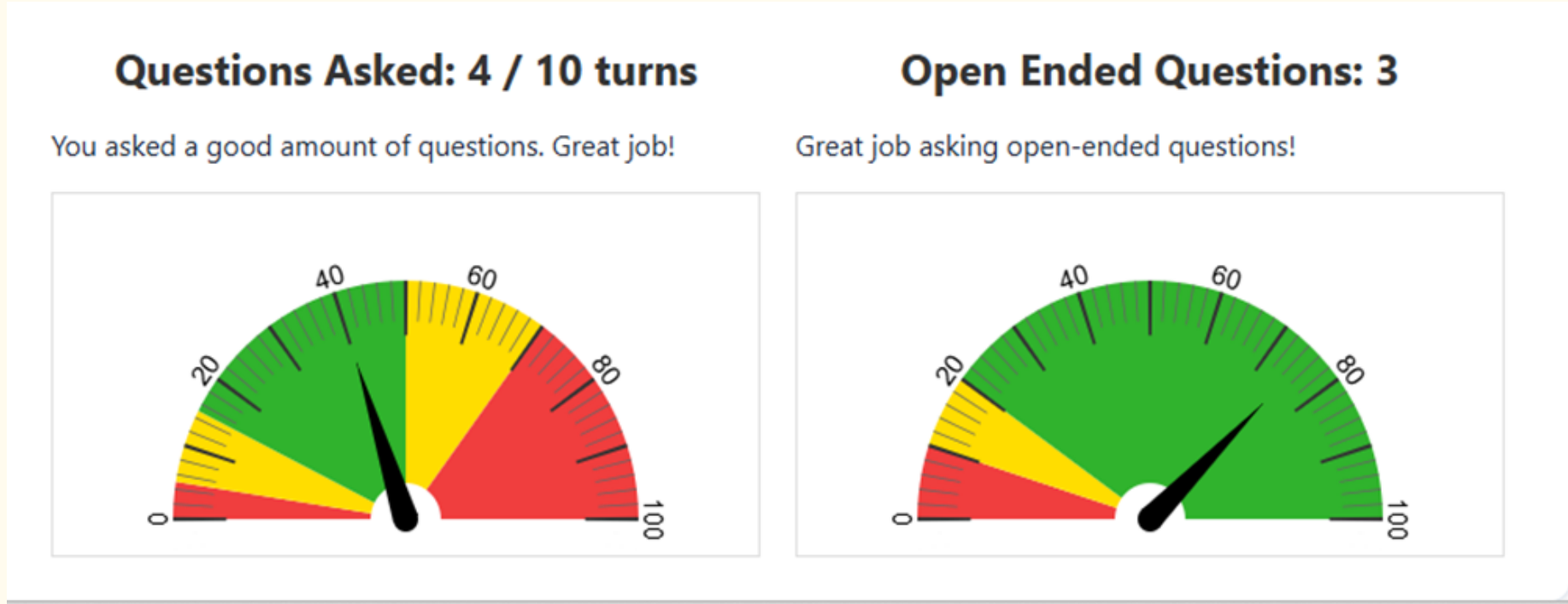
- Use patient’s last name initially:** Refer to the patient as Ms. Chen until you have established a relationship (*Invest in the Beginning*).
- Clarify plan for the visit:** Briefly explain what will happen during the visit (“First we’ll talk, then I’ll examine gums, and finally discuss cleaning options”), so Danielle knows what to expect.
- Further explore patient’s perspective:** Ask more about how the gum pain affects her daily life or feeling dental care (“How has this gum pain impacted your day-to-day activities?”).
- Explain procedures in more detail:** When Danielle asks about safety and pain, specifically describe why cleaning is important in pregnancy, what it involves, and how pain is managed.
- Warn before using instruments:** Explicitly acknowledge Danielle’s request to be warned before each instrument is used. Respond with, “Absolutely, I’ll let you know before I use any tools.”
- Summarize and check understanding at the end:** Before ending, review next steps and ask if she has questions (“Do you feel comfortable with what we discussed? Any other concerns?”).

Summary

- You established trust and responded to Danielle’s emotions well, especially regarding her past experience pregnancy concerns.
- Going forward, structure the visit more clearly, use her last name initially, and give detailed, step-by-step explanations about procedures and safety to further build her confidence.



RESULTS



- SOPHIE automatically collected communication behaviour data.
- Speech rate: 64 words per minute
 - Number of questions asked per scenario: 4,
 - Number of open-ended questions asked: 3,
 - Turn-taking: conversational turns per interaction 10

Qualitative Findings

User Experience: Mixed but Leaning Positive
Participants described the system as “strange” or “robotic,” noting repetitive questions, lag, and occasional misinterpretations. Despite these issues, most reported they could adapt and complete the scenarios with relative ease.

Educational Value and Feedback Impact
The feedback transcripts and keyword/empathy tracking were highlighted as especially valuable. Residents found script reviews useful for self-reflection, with non-native English speakers noting benefits in replacing jargon with patient-friendly terms.

Confidence and Communication Awareness
Several participants described greater awareness of pausing, listening, and asking open-ended questions. Some noted increased confidence, though others reported that the artificial nature of the interaction occasionally made them second-guess their responses.

CONCLUSION

LLM-based virtual patient simulations show promise as an innovative tool for communication training in dentistry. By exposing residents to diverse prenatal care challenges in a controlled environment, these models may enhance empathy, clarity, and cultural competence. Further studies with larger cohorts are needed to evaluate scalability and long-term educational outcomes.



Implications for Education and Practice
Despite these limitations, this study highlights important implications for dental education. SOPHIE could serve as a scalable supplemental tool to strengthen communication curricula, particularly in areas where resource-intensive standardized patients are impractical. The platform appears especially valuable for non-native English-speaking dentists, who reported that feedback enhanced their awareness of language choice and clarity. For dental programs seeking to integrate more structured communication training, AI-driven simulations like SOPHIE could provide a feasible, low-cost option to complement existing methods.

Future Directions
Future work should focus on improving the realism and flexibility of SOPHIE. Incorporating emotion and voice tone recognition, allowing for more dynamic dialogue, and reducing repetitiveness may enhance immersion and learning. Blending AI simulations with live standardized patients could balance scalability with authenticity, as participants in this study suggested. Larger studies across multiple institutions, with control groups and objective performance measures, will be necessary to establish the platform’s effectiveness. Finally, expanding scenarios beyond perinatal care to include diverse patient populations will improve generalizability and broaden educational value.

ACKNOWLEDGEMENTS

