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Applying Universal Design for Learning to Educational Chatbots: A Practical Framework

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Background and Context

SPEAK Project

The SPEAK project is part of Trinity College Dublin's Learning Innovation and Research Hub. SPEAK's objectives include:

- The co-design (with diverse students) of a simulation hub hosting a suite of realistic GenAI-driven patient chatbots for safe, independent practice of pharmacy consultation skills, with automated assessment and feedback.
- Creating a replication toolkit (templates and guidance) to enable adoption across disciplines beyond pharmacy.
- Developing a chatbot underpinned by inclusivity and **Universal Design for Learning** principles.

Universal Design for Learning and Chatbots – Research Gap

Research papers exploring chatbot use in different settings often lack detail on the steps taken to make them accessible, intuitive and inclusive.

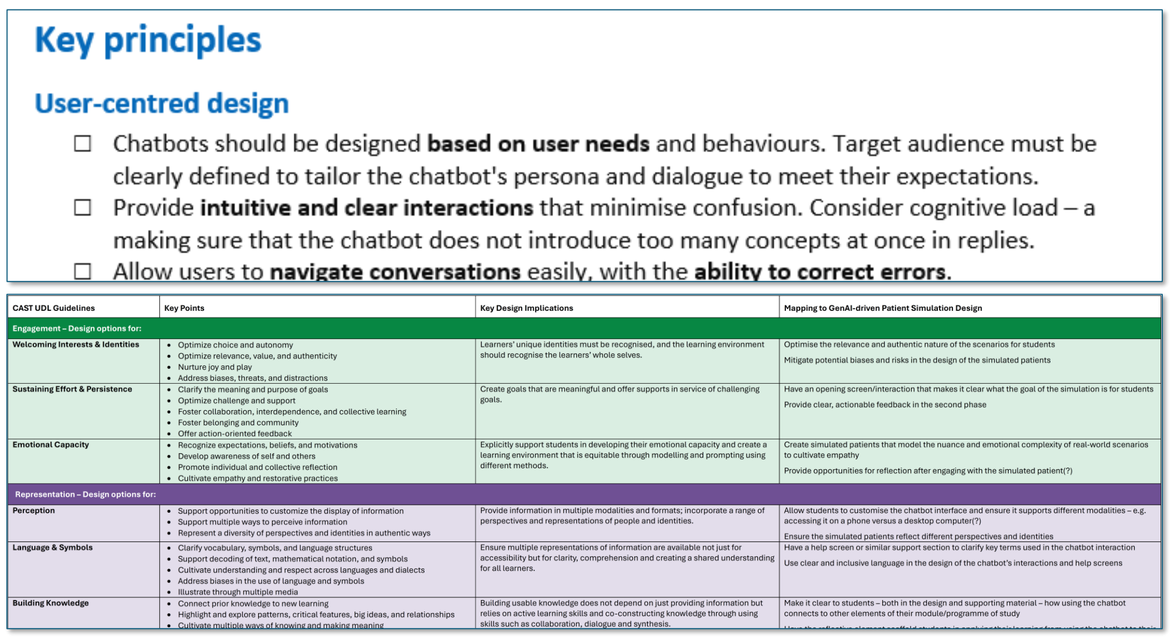
For example, in terms of usability, Kuhail *et al*. (2023) examined 36 papers on chatbots in education and found that none explicitly discussed drawing on usability principles at the design stage.

This indicates that many papers focus on chatbot effectiveness and implementation but provide limited exemplars for systematically embedding accessibility, inclusion, and learner variability considerations into the design.

Framework Development

We searched academic literature and online sources using UDL-related search terms to identify specific challenges associated with applying UDL principles to chatbots. Key design implications were explored from sources such as the University of Oxford's UX Centre of Excellence, and the collaborative project by CAST and the University of Macareta relating to UDL and chatbots. We also looked at literature from a variety of disciplines to explore practical examples of implementing UDL.

These have been synthesized into an approach that is transferable across disciplines and educational contexts, facilitating educators and researchers to address usability, inclusivity and accessibility in a balanced manner while maintaining focus on their primary project goals.



Key principles

User-centred design

- ☐ Chatbots should be designed **based on user needs** and behaviours. Target audience must be clearly defined to tailor the chatbot's persona and dialogue to meet their expectations.
- ☐ Provide **intuitive and clear interactions** that minimise confusion. Consider cognitive load – a making sure that the chatbot does not introduce too many concepts at once in replies.
- ☐ Allow users to **navigate conversations** easily, with the **ability to correct errors**.

CAST UDL Guidelines	Key Points	Key Design Implications	Mapping to GenAI-driven Patient Simulation Design
Engagement – Design options for:			
Welcoming Interests & Identities	• Optimize choice and autonomy • Optimize relevance, value, and authenticity • Nurture joy and play • Address biases, threats, and distractions	Learners' unique identities must be recognised, and the learning environment should recognise the learners' whole selves.	Optimise the relevance and authentic nature of the scenarios for students Mitigate potential biases and risks in the design of the simulated patients
Sustaining Effort & Persistence	• Clarify the meaning and purpose of goals • Optimize challenge and support • Foster collaboration, interdependence, and collective learning • Foster belonging and community • Offer action-oriented feedback	Create goals that are meaningful and offer supports in service of challenging goals.	Have an opening screen/interaction that makes it clear what the goal of the simulation is for students Provide clear, actionable feedback in the second phase
Emotional Capacity	• Recognize expectations, beliefs, and motivations • Develop awareness of self and others • Promote individual and collective reflection • Cultivate empathy and restorative practices	Explicitly support students in developing their emotional capacity and create a learning environment that is equitable through modelling and prompting using different methods.	Create simulated patients that model the nuance and emotional complexity of real-world scenarios to cultivate empathy Provide opportunities for reflection after engaging with the simulated patient(?)
Representation – Design options for:			
Perception	• Support opportunities to customize the display of information • Support multiple ways to perceive information • Represent a diversity of perspectives and identities in authentic ways	Provide information in multiple modalities and formats; incorporate a range of perspectives and representations of people and identities.	Allow students to customise the chatbot interface and ensure it supports different modalities – e.g. accessing it on a phone versus a desktop computer(?) Ensure the simulated patients reflect different perspectives and identities
Language & Symbols	• Clarify vocabulary, symbols, and language structures • Support decoding of text, mathematical notation, and symbols • Cultivate understanding and respect across languages and dialects • Address biases in the use of language and symbols • Illustrate through multiple media	Ensure multiple representations of information are available not just for accessibility but for clarity, comprehension and creating a shared understanding for all learners.	Have a help screen or similar support section to clarify key terms used in the chatbot interaction Use clear and inclusive language in the design of the chatbot's interactions and help screens
Building Knowledge	• Connect prior knowledge to new learning • Highlight and explore patterns, critical features, big ideas, and relationships • Cultivate multiple ways of knowing and making meaning	Building usable knowledge does not depend on just providing information but relies on active learning skills and co-constructing knowledge through using skills such as collaboration, dialogue and synthesis.	Make it clear to students – both in the design and supporting material – how using the chatbot connects to other elements of their module/programme of study

Screenshots of excerpts of the UDL checklist and design table

Discussion & Future Plans

Terminology regarding chatbots' usability, inclusivity and accessibility varies in the literature. Using the UDL principles as the basis for collating these concepts in a chatbot-specific framework provides a means of addressing these aspects consistently and coherently. CAST's UDL framework has been used in other contexts such as simulation-based health professional education (Doyle, 2025) but its incorporation into an adaptable educational chatbot guidance framework represents a novel approach.

The Learning Innovation & Research Hub within our Centre for Academic Practice is currently working with academic colleagues to create three chatbots for use in different educational contexts, enabling the utility of this approach to be confirmed.

Scan to learn more

Acknowledgements & References

References

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