# Students' Perceptions on Chatbots' Potential and Design Characteristics in Healthcare Education

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**Abstract.** Chatbots may have the potential to support healthcare education by enabling personalized learning. Trust is a pre-requisite for the users to accept the chatbots. In this study we analyzed students' assignments of the MSc course "User Needs, Requirements Engineering and Evaluation'' at Karolinska Institutet, aiming to explore the chatbots' potential in healthcare education and the design characteristics of chatbots that may enhance the trust. The students identified two courses: pharmacology and medical law, that have the potential to leverage chatbots' characteristics. Our analyses on the design characteristics they suggested resulted in: recognition; visibility of system status; anthropomorphism in communication; knowledge expertise, linguistic consistency; realistic interaction. Our results are in line with previous research. Future studies could investigate the educational impact on the learning outcomes and students' satisfaction when interacting with chatbots.

**Keywords.** Chatbot, healthcare education, design characteristics

## 1. Introduction

Personalized learning has the potential to improve the decision making skills of physicians [1] by allowing greater transfer and cognitive flexibility which may be especially important for future healthcare professionals and lifelong learning [1]. As life sciences are shifting towards personalized medicine, training of healthcare professionals who enter the era of personalized medicine is of utmost importance and therefore the traditional academic setting has to adapt to include personalized healthcare education aids [3]. There is growing evidence around chatbots, understood in this context as conversational agents that they have the potential to change the way students learn and search for information. "*Chatbots are interactive, virtual agents that engage in verbal interactions with humans. This technology is an interesting case in human-machine interaction as they are designed to interact with users through the*

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*usage of natural language based on formal models*'' [4]. Chatbots have the potential to facilitate various processes, particularly those related to customer service and personalization because of their accessibility, scalability and relatively low cost [4].

In the context of healthcare education, chatbots may quiz existing knowledge, enable higher student engagement with a learning task or support higher-order cognitive activities [5]. Existing chatbot solutions have been studied before for their technical potential [6]. In large-scale learning activities involving a high number of students, chatbots are able to solve the problem of individual student support and contribute to personalized learning. However, limited examples of chatbots in European Healthcare Curricula have been utilized. For students but also teachers to accept and utilize the advantages of such solutions it is important to introduce trust towards the performance of a chatbot. Trust may be understood in terms of credibility and confidence in one another's judgment, as well as predictability of one's behavior [7]. There are therefore specific design characteristics of chatbots that can enhance the users' trust and therefore support chatbot's potential into healthcare education.

In this study we explored the students' perceptions on the healthcare curricula needs that the chatbots have the potential to support as well as the design characteristics of chatbots that may enhance users' trust in the identified educational domain.

## 2. Methods

Karolinska Institutet launches the international Master program Health Informatics. One of the courses that students have in the second semester is the "User Needs, Requirements Engineering and Evaluation''. The aim of this course is to provide students tools and methods to analyze and model needs and requirements of patients, healthcare professionals and care providers, as well as to evaluate eHealth systems in different contexts [7]. The students taking this course during January 2020 were asked to identify potential application of chatbots into the healthcare curricula and to design basic paper or computerized prototypes that envision the chatbots' functionalities, focusing on the chatbots' design characteristics that have the potential to enhance the users' trust. Nine students were assigned in two different groups. They were given in total four weeks for both assignments while they were provided with feedback. We performed a thematic content analysis on the results of the students' assignments regarding the design characteristics that can benefit the end users' trust and we report on the potential of the chatbot in healthcare education as well as the envisioned prototype functionalities. This study falls outside of the vetting process of research in accordance with the Swedish Ethical Review Act (2003:460) as it does not handle sensitive personal data as defined in GDPR. Further the students were informed that the assignment could be used for research purposes and their consent was acquired.

## 3. Results

### 3.1. Potential need for chatbots in healthcare education

The students identified pharmacology and medical law as the courses that the chatbots have the potential to support. In particular the chatbots could facilitate memorizing

concepts, such as pharmacological formulas but also laws, and enable focusing on local variances in healthcare in both pharmacology and law disciplines.

## 3.2. Design characteristics of chatbots in healthcare education

Our thematic content analysis on the chatbots' design characteristics that can enhance the end users' trust resulted in the following categories:

- Recognition: The students designed the chatbots resembling well-known messenger applications for the purpose of enhancing the users' trust by the technical predictability. Recognition [9] with the interface is also enhanced by the fact that the students selected the chatbot's colors and interface characteristics based on the learning management system and the website of Karolinska Institutet.
- Visibility of system status: The students designed their chatbot including status visibility [9] so that the end users are aware about the system's operation and status by using symbols such as [Typing] [seen] [time].
- Anthropomorphism in communication: The students suggested that the chatbot should communicate in a human like way; understand natural language and recognize emoji's. To enhance chatbot's anthropomorphism [4] the students suggested that it should be friendly, relatable and able to joke.
- Knowledge expertise: To establish trust the students suggested that the chatbot shall provide precise and reliable information, including links to reliable resources and references. Moreover the students suggested that the chatbot knowledge base should be limited to the defined subjects.
- Linguistic consistency: The students suggested that the chatbot shall be consistent in terms of the language and terminology it is using, including standardized medical terminology.
- Realistic interaction: The whole process of initiating a discussion and interacting with the chatbot shall follow a realistic and logical flow, similar to real conversation in a real world.

## 3.3. Chatbot prototypes' functionalities

The students designed both low and high fidelity prototypes. The pharmacology course chatbot prototype functionalities allowed the user to log in; test and quiz knowledge; request additional information on a topic. The medical law chatbot functionalities allowed the user to log in either as a medical professional or student and request information on different medical law sub-topics or request to receive updates.

## 4. Discussion

The students identified two courses, the pharmacology and medical law that chatbots have the potential to support. Our thematic analyses on the students' assignments resulted in six categories summarizing the chatbots' design characteristics that have the potential to enhance the end users' trust and by that support their integration into the healthcare curricula. Our results are in line with previous research [4] regarding the anthropomorphism of chatbots having the potential to enhance the users' trust.

Moreover, Nielsen's design principles [9] were regarded by the students as applicable to the chatbot's designing process.

The students working on the assignments had mixed medical and technical backgrounds which is one of the study's strengths. However their number was limited (nine) and the results might not be generalized. Another limitation is that they received feedback during the assignments' development process that might have influenced the results. The assignments' duration was limited and did not include actual stakeholders which might influence the analysis' depth. Future studies could investigate the educational impact on the learning outcomes and students' satisfaction with chatbots.

## 5. Conclusion

Chatbots have the potential to support students in a personalized and interactive way. Our results provide new knowledge about the potential of chatbots in healthcare education and insights about design characteristics that may enhance the users' trust.

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