Users' needs assessment for chatbots' use in Higher Education

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Abstract. Higher education comprises an important field for the application of chatbots, especially for large-scale use. This paper reports on a needs assessment that was conducted with higher education users (i.e., educators and students) for examining their needs and expectations on chatbots' integration in educational settings. The study was conducted in the context of a research project that includes a series of iterative pilot studies of the use of chatbots in higher education. We report on findings from one of the pilots based on data from semi-structured online interviews with higher-education students and educators. A thematic analysis of the interview data resulted in different themes of needs that users have in education. The outcomes of this study indicate that higher-education users need technological solutions that can support content delivery, formative assessment implementation with the provision of qualitative feedback, research tasks processing and social bonding facilitation. Those findings, along with interviewees' suggestions on functionalities and features that chatbots should have, provide guidelines and recommendations for the design, development, and implementation of different scenarios of the use of chatbots in higher education.

Keywords. Higher Education, Chatbots, Needs Assessment.

1 Introduction

'A computer, program, algorithm or artificial intelligence which communicates with a person or another participant of the communication can be called a chatbot' (ZEMČÍK, 2019, p. 14). Chatbots comprise computer programs that are used to simulate auditory and/or textual conversations with users, or other chatbots using natural languages (Shawar & Atwell, 2007). Chatbots - also called machine conversation system, virtual agent, dialogue system, and chatterbot - commonly appear in customer services responding to frequently asked questions (FAQs) and offering technical support, in business webpages for selling products, and as personal assistants on mobile devices (Serban, et al., 2017). They are becoming a trend in many fields such as medicine, product, and service industry, and lately in education.

Chatbots' conceptualization emerged from the need of human to interact with computes in a natural human language. A key milestone in the pre-history of chatbots holds in the so-called Turing test. In the 1950s, the possibility of training a computer machine to launch conversations with users led Alan Turing proposing the Turing test; a program that developed a text message conversation with a prober for five minutes (Turing, 2009).
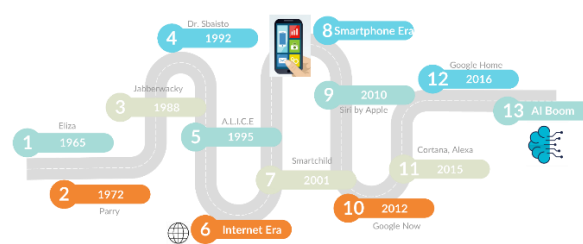

Figure 1. Timeline of chatbots

Following this, ELIZA, the first chatbot in the history of Computer Science was created in 1964-1966 by Joseph Weizenbaum at Massachusetts Institute of Technology (MIT) (Kane, 2016; Khan & Das, 2017; ZEMČÍK, 2019). ELIZA used simple pattern matching and a template-based response mechanism to imitate the conversational style of a nondirectional psychotherapist, in the early scenario called DOCTOR. A record of resultant chatbots which were developed following this critical milestone, encompasses, among others, Parry (1972), Jabberwacky (1988), Dr. Sbaisto (1992), and A.L.I.C.E. (1995) (see Figure 1). The use of chatbots increased dramatically with the massive expansion of the Internet and especially social networking sites. Chatbots have been further advanced in the last decade, due to the development in natural language processing and machine learning algorithms, such as deep learning and neural networks which

perform Artificial Intelligence (AI) tasks like Image Recognition, Natural Language Generation, Speech Recognition and Text to Speech Synthesis (Khan & Das, 2017).

1.1. Global Trends and Analysis

The chatbot industry has flourished a lot in recent years, demonstrating the strength and opportunities in this direction. Even though the idea of chatbots appeared first in the 1960s, it took more than half a century for the world to become ready for implementation into real life -- mainly thanks to the rapid progress in natural language processing, AI, and the global presence of text messaging applications. At the same time the text communication became the socially acceptable form of personal interaction, as this can has become evident from the massive usage of messaging apps worldwide. People increasingly prefer chatting over a mobile device, rather than personal contacts or even making phone calls. Technology high rollers, such as, Microsoft, Facebook, Google, Amazon, IBM, Apple, Samsung etc., provide several possibilities to the users for accessibility in open platforms and chat applications, in which chatbots make their appearance.

In relation to the current trends on the use of chatbots, statistics from Statista (2018) demonstrate the preferences of customers who interact with different customer services online, between a chatbot or virtual assistant and a live customer service representative, as of 2017. At the time of the survey, 34 percent of respondents stated they would be comfortable receiving customer service from AI in an online retail situation, whereas, healthcare and telecommunications were detected to be the second and the third in respondents' preferences correspondingly.

Essential to consider along these lines is the fact that, many consumers are showing reluctance to use new applications, let alone that it is unprofitable to create, promote and bring into operation some new application, that will ultimately make no use (Commerce Times, 2017). This trend may be considered by developers while choosing the medium through which new chatbots are developed and can be accessed (i.e., web-based applications that run on a remote serves and can be accessed through a web page, Vs stand-alone applications).

1.2. Chatbots in Education

While the presence of chatbots, on web platforms and/or standalone applications, is already substantial in customer services, business webpages, products sales, and in health interventions, their use for educational purpose is still in its infancy. A meaningful integration of chatbots in higher education presupposes a good understanding of users' needs and expectations, as well as, an examination of their perceptions towards educational technology (Keller & Cernerud, 2002; Popovici & Mironov, 2015), the adoption of an appropriate pedagogy (Gonda, Luo, Wong, & Lei, 2018), and last but not least, a confrontation of technological challenges and potential limitations, that relate to the Natural Language Processing (NLP) research field (Yan, Castro, Cheng, & Ishakian, 2016). In this paper we focus on the examination of users' needs and expectations in relation to the use of chatbots in education.

Previous research focusing on the examination of higher education users' needs and expectations on the use of chatbots in education has already been done to some extent, projecting possible uses of chatbots in education (e.g., Gupta, et al., 2019; Lee, et al., 2019; Stathakarou, et al., 2020; Thies et al., 2017). Findings of those studies outline the potential use of chatbots as career advisors (see Lee, et al., 2019), or intelligent tutors answering student questions (Gupta, et al., 2019). Furthermore, the intentional design and development of personalities for chatbots - building on a need analysis outcome derived from exploratory interviews and focus groups with students - is documented in the work of Thies et al. (2017). Their findings revealed students' needs and expectations on having a chatbot helping them become knowledgeable and successful in their career aspirations; interviewees in the same study also referred to the need of having an entertaining chatbot, with whom they could share fun experiences. Finally, there were a few others who wanted the bot to listen to them, help them improve their soft skills and help them become desirable in their social circles (Thies et al., 2017). Those findings indicate an association between the chatbot personality and the kind of user-chatbot interactions that might take place.

Moreover, chatbots have been examined for their potential in healthcare education with a focus on how the design characteristics of chatbots (i.e., recognition; visibility of system status; anthropomorphism in communication; knowledge expertise, linguistic consistency; realistic interaction) may enhance the feeling of trust (Stathakarou et al., 2020). Even though those findings emerge from healthcare education, they suggest the potential of chatbots to support students in a personalized and interactive way.

2 This study

This manuscript reports on a needs assessment study which took place in the context of the EDUBOTS (Best practices of pedagogical chatbots in higher education) Erasmus Plus Project and a European Union's Horizon 2020 Project. This work contributes to the current state of knowledge on chatbots, in the sense that we tried to explore in a more holistic manner the needs of higher education users (i.e., both students and educators) who have different backgrounds. We report a qualitative

investigation of the potential use of chatbot in higher education. In this respect, the present study focuses on fulfilling the needs and expectations of higher-education students and educators, with the introduction of a chatbot in higher education settings. The following research questions were sought to be addressed:

(1) What are the needs and expectations of higher education students and educators for the use of chatbots in higher education?
(2) What are the proposed features and functionalities that chatbots should have to meet these needs and expectations?

3 Methodology

3.1. Participants

Ten higher education instructors (3 females and 7 males) and eight undergraduate students (2 females and 6 males) from different local universities in Cyprus and with different backgrounds (i.e., Multimedia and Graphics Arts, Computer Science, Sports & Exercise Science) participated on a voluntary basis in this study. All the participants consent to anonymously use the data for research purposes.

3.2. Data Collection

Semi-structured interviews were driven by a protocol, developed by the authors. The interview protocol included a demographic data section, followed by a second section with eight questions concerned with users' previous experience with chatbots (e.g., *Have you ever interacted with a chatbot before? If yes, how did you use the chatbot exactly? How was your overall experience? Positive, negative? Why?*), and a third section of four questions focusing on their expectations on a potential chatbot use in education for easing the learning/ teaching process, the social bonding among users, and any other scenarios that they could think of (e.g., *In your opinion, could a chatbot facilitate your learning/teaching progress? How? Please explain your reasoning. Can you describe a scenario where the chatbot serves your needs in this context?*). During the interviews and while discussing questions from the third section, the interviewees were prompted to also refer to specific features and functionalities that chatbots should have for meeting their needs and expectations.

3.3. Data Analysis

The interviews were transcribed verbatim. A thematic analysis approach (Patton, 2015) was adopted, involving an open coding process followed by clustering of the emerged codes into broader themes portraying: (1) users' needs and expectations for the use of chatbots in higher education, and (2) proposed

features and functionalities that chatbots should have for meeting their needs and expectations.

4 Results

First, the findings disclose that all the interviewees appeared to have had experienced at least once in the past, a chatbot interaction, mostly in customer service instances. Three of the instructors were also involved in chatbot development processes, for simple solutions, and as part of research projects. Previous experience with chatbots was characterized as either positive or negative (see Table 1). Interviewees' responses were clustered, as illustrated in the table that follows.

Table 1. Self-evaluation of interviewees' previous experience with chatbots

Positive experience	Negative experience
The bot responded to the user's questions.	The bot cannot handle complex conversations.
The bot had a character.	Absence of anthropomorphism in communication (at a certain point the user can understand that it is a software, not a human)
24/7 availability and fast response of the bot.	Felt uncomfortable talking to a machine.
Realism.	Expected reactions / answers from the bot were received.
A degree of personalization.	Not adequate personalization: the bot did not address user's needs.

Based on previous experience, suggestions for improvements were proposed, such as: (1) the chatbot should have a character, (2) there should be a consistency in the responses of the chatbot, (3) the chatbot should be able to understand culture-related factors, if possible, and (4) the chatbot should be able to delve into a topic. Despite the references to some negative previous experiences, all the interviewees were positive with respect to a future prospect of chatbots.

4.1 Needs and expectations of higher-education end users for the use of chatbots in higher education (RQ1)

Interviewees' expectations for the use of chatbots were clustered into different themes (see Table 2). In particular, chatbots were envisioned as facilitators in the teaching and learning process for supporting

formative assessment, remote tutoring, and administrative work. Also, chatbots were envisaged as digital assistants in research-related processes (e.g., grant preparation), and in other scenarios not related to education (i.e., health care, customer service, in society addressing citizens' needs, and in the fitness industry). Interviewees were explicitly questioned about their potential needs and expectations for the use of chatbots for social bonding; this type of use was tolerated by some of the interviewees, while others did not express concerns. We elaborate on the emerging themes related to educational applications, further below.

Table 2. Interviewees' expectations on the use of chatbots

Themes	Uses	Proposed by
Learning and Teaching	1. Formative assessment	Students and educators
	2. Remote tutoring and course content support	Students and educators
	3. Admin work	Educators
Research	1. Grant writing	Educators
	2. Conference / seminars organization	Educators
Social bonding	1. Student – student and student – mentor bonding facilitated by a chatbot	Students and one educator
Other uses	1. Health care	Educators
	2. Customer service	Students and educators
	3. Societal role	Educators
	4. Fitness industry	Educators

4.1.1 Teaching and Learning

According to the student and educator interviewees, chatbots can help to facilitate the teaching and learning process; specifically, chatbots were envisioned as virtual/ digital assistants, smoothing the implementation of formative assessment, by providing grades and/or qualitative and personalized feedback to the students, but also for conducting short quizzes, during an academic semester, for assessing students' conceptual understanding. The educators in particular, mentioned

that this need is imperative especially in large-scale classes, in which the provision of personalised feedback, in a formative and qualitative manner, during the semester might be an unrealistic scenario. Indicative quotes are given below.

"After each lecture you could have some questions, to test students' conceptual understanding" (educator 2)

"A chatbot to offer personalized feedback to the students. If there was such a bot, that would be a blessing. Especially for large audiences. But it should be a smart chatbot, so that it does not give feedback just to give, but a chatbot that is really capable of judging the quality of the work" (educator 3)

"[…] or if the chatbot could be used for giving feedback to our assignments" (student 2)

The interviewees were particularly asked about the potential and envisioned role of chatbots in education, for facilitating formative assessment practices (Figure 2), but also their current needs for tools that could ease the implementation of formative assessment. The educators referred to an extensive list of tools/ platforms that they already use in their classes for file sharing, assessment, and communication purposes (e.g., Blackboard, Moodle). However, they admitted that they currently miss a tool and/or an agent that can somehow link all the platforms and tools that they use, or they miss a tool that supports, in a smart way, all the kind of different tasks that the aforementioned tools/ platforms support. In this respect, chatbots could somehow offer a solution.
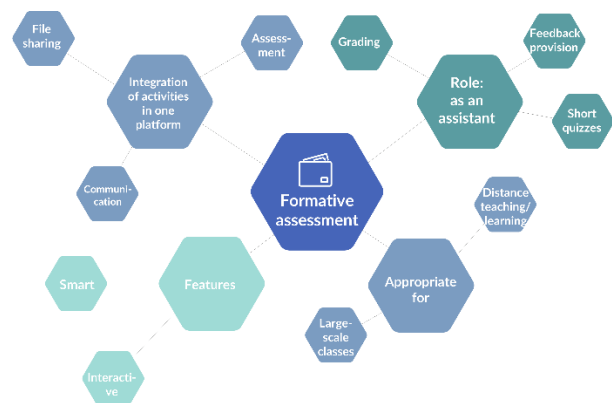

Figure 2. Potential role of chatbots in formative assessment practices

Related to the assessment need, one of the educators particularly proposed the possible use of a chatbot, at the beginning of each semester, for assessing students' prior and prerequisite knowledge that is required for a given module. Overall, it was stressed by the interviewees that chatbots could add value in formative assessment practices and would be especially considered as appropriate for large-scale classes and distance teaching and learning.

Furthermore, chatbots could add value by offering content support to the students, in course related topics,

especially for addressing students' content-related questions. In this respect, chatbots could act as remote tutors, offering tutorials to the students, sharing, and filtering relevant to the course resources and having a mediating role to the instructor to intervene when needed.

"If we could have a chatbot offering support step-by-step to the students, that would be useful. That is, to have a chatbot, as a remote tutor, guiding the students on how to solve a problem" (educator 7)

"We are interested in having something to assist us on bibliography search or to help us find a specific reference [...] Also, when you are learning a new language would be nice to have some advice [...] chatbots could offer useful tutorials in coding" (educator 8)

"Anything related to lecture content, so content that the students need to learn about; I think the chatbot can replace the teacher in some basic content concepts" (educator 9)

The 24/7 availability of chatbots could then allow students to seek for support, at any time of the day. Some of the students referred to the value of having a chatbot acting as a remote tutor, especially for those who study late hours and when it is not feasible to directly communicate with the educator. Also, it appears that the students need a facilitator in understanding content-related concepts; as proposed, the user could enter some keywords in the conversation and then, the chatbot could filter and retrieve relevant resources.

"When I need help and support at any time of the day, instead of waiting for an answer from the teacher via email or until I go back to class or through some other social media platforms, I think it would be a good solution to have a chatbot answering my questions" (student 2)

"A chatbot could do what the google scholar does, for example. Where you enter some keywords and then the engine provides you with relevant resources [...] For example, you study for the Chemistry class and you come across terms and concepts that you do not know, e.g., molecular coupling. Then you could ask the chatbot for help for those concepts." (student 6)

"I usually read very late at night and when I have questions it is not possible to directly reach my teacher at that time. If I could have a chatbot answering my questions, well, this way my questions will be answered faster" (student 8)

Moreover, few of the instructors stated that there is a need of having a chatbot that responses to commonly asked questions, posed by students; yet, the chatbot should be able to recognise when the educator should intervene in the conversation, and at that point, it should initiate the conversation/ communication between the student and the educator.

"The bot could answer students' content-related questions that are trivial; ideally, the chatbot should be able to understand when I – as an instructor- need to intervene in the chatbot-student conversation and thus the chatbot should initiate such a communication with my students" (educator 3)

Apart from that, most of the interviewees, acknowledged the potential added value of chatbots in responding to frequently asked questions (FAQs), while most of those often relate to administration (e.g., deadlines). Educators referred to the struggle of handling a large amount of administrative work, on the top of their teaching and research duties, such as, collecting assignments, sending to the students reminders for their assignments' deadlines, responding to FAQs related to the course, and even responding to questions on how to handle a submission of an assignment. It was proposed by the interviewees, that chatbots could provide a lot of support in this direction, thus, reducing the often-observed workload due to such matters. As one of the educators explicates:

"[...] in this way, the integration of chatbot in education could reduce the teacher's time by saving valuable hours." (educator 2)

The particular educator, emphasized that, it is more important having a chatbot responding to content-related issues, than administrative matters, since the latter can be also addressed now through the mass amount of information that students already receive in social networks and e-learning systems.

4.1.2 Research

Interestingly, two of the educators expressed the need for having a virtual assistant for fulfilling a grant application (mostly on the technical parts of an application), and for offering support during the organization of conferences and seminars (e.g., a chatbot contacting the participants, responding to queries, sending the agenda). An indicative quote is given below.

"My work is not so standard, and I often fight with colleagues to do the basics, to organize a meeting. Another thing is that I would like to have a tool guiding me, as a researcher, to fill in a grant application. Something like a form filler, something effortless to the user." (educator 7)

4.1.3. Social bonding

On the social bonding scenario, one of the educators acknowledged the need for using a chatbot for social bonding among students and/or with other colleagues. However, the rest of the educators appeared to be reluctant for the use of chatbots for social bonding; they explicated their view with reference mainly to cultural factors that might hamper such a use. Also, based on their own personal

experiences, social bonding with peers was not considered an issue, thus, making the application of chatbots in this scenario inappropriate to them. However, three of the student interviewees referred to the need of having a chatbot facilitating inter-social bonding with peers and with mentors. Such a solution would establish connections among students or between students and mentors, which could then comprise channels for communication for resolving any course or university-related issues that the students confront during the academic semester.

"A chatbot could actually accommodate social bonding with peers. Ok, with friends and fellow students there are other means of communication, such as, messenger, Viber, or anything else that we use now. But there are some researchers, so-called mentors, who are at the university and we do not see them often, but they help in some way to conduct the course. Other times we have tutoring with mentors. With the use of a chatbot, we will be able to communicate with them, just like having a remote tutor at any time, without requiring getting to know the mentor in person." (student 8)

4.2 Proposed features and functionalities that chatbots should have (RQ2)

For the successful integration of chatbots in higher education, features and functionalities were proposed by the interviewees (see Table 3). Features that the chatbots should have for successfully enacting the role of virtual assistants include intellectual independence (smart chatbots) and interactivity. In particular, the expectation of having a chatbot that can delve into a topic, handle complex conversation, respond to content-related questions and offer personalized feedback, requires intellectually independent/ smart chatbots, which generate responses out of the input with the help of machine learning techniques.

"I think especially for the integration of chatbots in education, it is essential to have a smart chatbot, that understands what I have asked, that responds in essence and to the point" (educator 3)

Adaptation and personalization for addressing users' needs and particularities (e.g., adapting to culture-related factors) was also mentioned as essential for the meaningful integration of chatbots in education in general.

"The chatbot should be able to understand more culture-related factors; in HCI fields a focus on emotional and cultural factors has already arisen. In this way, the chatbot's response will not feel such automated" (educator 4)

Table 3. Proposed features and functionalities of the chatbots for their meaningful integration in Higher Education

Features and functionalities	Details	Proposed by
Smart chatbot	The chatbot can delve into a topic, handle complex conversations, and offer personalized feedback.	Educators
Adaptation and personalization	The chatbot responds to different user needs, e.g., understands culture-related factors.	Educators
Appropriate design	The chatbot has a character, is friendly and sustains interaction with the user. It can also offer visual input.	Students and educators
Low maintenance cost	Safeguarding sustainability of use.	Educators

In addition, the need for having an appropriate design was stressed (e.g., friendly-user interface), the chatbot having a character, which can safeguard and sustain the chatbot-user interaction, but also the possibility to support functionalities such as, offering visual input (e.g., video tutorials), and filtering information available on the web. Last, the maintenance cost was proposed as one of the factors that might hinder the sustainable use of chatbots. Specifically, even though it was acknowledged by the educators that the design and development of chatbots might cost less compared to other conventional methods of using human assistants, the need for having also a low maintenance cost was proposed as another necessary feature.

5 Discussion

Chatbots are emerging as potential facilitators in higher education. The design and development of solutions requires an assurance that the end users' needs are met. As part of our need's assessment, aiming at understanding the needs of educators and students, we tried to extract the perceived features and functionalities that chatbots should have.

Findings from this study indicate that higher education instructors currently struggle with content delivery, formative assessment implementation and time-consuming administrative work. Likewise, students confirmed the need of having a tutor for content support provision, a finding consistent with the work of Gupta, et al. (2017; 2019). Students also

expresses their need for having a chatbot responding to FAQs at any time of the day (such as: Watson, reported in Goel et al., 2015; EduBot, reported in the study of Verleger & Pembridge, 2018). In fact, solutions have previously been developed for addressing such issues to some extent. For instance, Goel and colleagues (2015) developed a chatbot, called 'Jill Watson'[1], built on IBM's Watson platform, that functioned as a teaching assistant, to handle forum posts by students enrolled in a computer science course at the University of Georgia (Goel, et al., 2015). In this case, there was a need by the instructor to address numerous questions of students during the semester. The Jill chatbot is recorded as the world's first AI teaching assistant, that was available 24/7 for responding to M.S. Computer Science students' queries. It was observed that the use of the chatbot by students enhanced their engagement in the course. Therefore, the development of the teaching assistant chatbot helped in solving this problem to a great extent. In the same direction, Dutta (2017) describes in detail the development process of an intelligent chatbot to assist high-school students for learning general knowledge subjects. The proposed intelligent web-based and free access chatbot tool makes use of NLP techniques to answer the queries by high-school students and be trained on a knowledge base comprising of general knowledge questions and answers. In relation to formative assessment solutions, Yi-Chieh and Wai-Tat (2019) explored the use of a conversational chatbot interface for guiding students to perform peer assessments. Even though their findings are promising in this area, as grading consistencies were exhibited among students' and teachers' evaluations, the use of chatbots for the provision of qualitative feedback continues to comprise an area for further investigation.

Overall, the challenge remains on building and sustaining the use of a smart chatbot, capable of delving into content-related topics of a course and offering personalized guidance and feedback to the learners. Even though chatbots can evolve via machine learning techniques and through evaluating conversations with users, the error rate at which a chatbot works is initially high (Molnár & Szüts, 2018). Also, according to the same authors, even though chatbots can simplify the administrative work of educators by disclosing supplementary information to students about their courses, they often fail to solve content issues. This becomes a bit problematic when chatbots are meant to be used for meaningful formative assessment purposes and content-related guidance provision. Therefore, the need for having chatbots that support formative assessment and tutoring in a meaningful manner and content-wise remains.

Moreover, another need that was identified through our interviews relates to a use of a chatbot for easing research grants preparation procedures, such as, filling in parts of an application. To the extent of our knowledge, there is no such a solution at the moment for addressing this need; hence, this may be another direction for further design and development.

In addition, the social bonding scenario was endorsed by some of the interviewees; in this case, the need for connecting and communication with peers and mentors within an academic environment, without the prerequisite establishment of relationships and/or friendship among the users, was proposed. In this direction, a chatbot could be used for initiating such connections, with further implications on student retainment at the university, establishment of study groups among students of the same department and provision of feedback and support from mentors to freshmen who struggle with content but also administrative matters of the academic life. Nevertheless, potential constraints should be encounter in such a solution, such as, cultural differences of users, as pointed out by our interviewees who displayed reservations on the successful use of chatbots for this purpose.

In relation to the essential features that chatbots should have for addressing interviewees' needs, intellectual independence was proposed. The first characteristic was viewed as crucial for a chatbot to have, in order to be able to aide significantly in formative assessment and tutoring solutions, which prerequisite a meaningful content analysis and interpretation of users' responses in chatbot-user interactions. This would also result into linguistic consistency and a realistic user-chatbot interaction, needs which have been outlined also in the study of Stathakarou, et al. (2020). Adaptability in users' personal needs was also proposed along these lines, including acceptance of cultural differences among users. Such a feature would allow the accommodation of chatbots' use not only for teaching and learning, but also for social bonding uses. Those features would then result in the presence of anthropomorphism in communication, as the latter has been also been proposed by users as an essential design characteristic of chatbots for uses in education (see Stathakarou, et al., 2020). In terms of design, our interviewees additionally proposed the requirement for a chatbot to support visual input (e.g., video tutorials), and to exhibit a character, in order to sustain user interaction with the system. The development of personalities for chatbots have been explored in more depth in the needs' assessment study of Thies et al. (2017), and its necessity has been confirmed through our findings as well. Last, technical matters, such as, the maintenance cost, was noted as one of the factors that might affect sustainability of use, especially in the education sector.

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[1] https://www.ibm.com/watson

6 Conclusion and limitations

In response to the current trend of integrating chatbots in education, and as part of our work in a project that follows an in this manuscript, we report a needs assessment study. The purpose of our study was to identify and explore higher-education users' needs and expectations for the use of chatbots in higher education, through the conduction of semi-structured interviews. It has been shown that users have several needs related to the teaching and learning processes, related to research and to social bonding matters, that chatbots could potentially address, through an appropriate design. The findings of this study have implications for our future steps for the design, development and testing of specific pedagogical scenarios for the meaningful integration of chatbots in higher education. Yet, it must be mentioned that, in this work, the interviewees came from a single country, as they were reached by convenience. Thus, the findings presented in this manuscript, reflect the needs and expectations of a particular group of users. In our future work, and as part of the iteration cycles of design in our project, we aim to include participants from a wider region and other cultures.

References

Commerce Trends. (Aug 31, 2017). Consumers' Embrace of Mobile Apps Is Limited to a Choice Few. Retrieved from: https://www.ecommercetimes.com/story/84766.html

Goel, A., Creeden, B., Kumble, M., Salunke, S., Shetty, A., & Wiltgen, B. (2015, September). Using watson for enhancing human-computer co-creativity. In 2015 AAAI Fall Symposium Series.

Gonda, D. E., Luo, J., Wong, Y. L., & Lei, C. U. (2018, December). Evaluation of Developing Educational Chatbots Based on the Seven Principles for Good Teaching. In 2018 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE) (pp. 446-453). IEEE.

Kane, D. A. (2016). The role of chatbots in teaching and learning. E-Learning and the Academic Library: Essays on Innovative Initiatives, 131.

Keller, C., & Cernerud, L. (2002). Students' perceptions of e-learning in university education. Journal of Educational Media, 27(1-2), 55-67.

Khan, R., & Das, A. (2017). Build better chatbots: a complete guide to getting started with chatbots. Apress.

Molnár, G., & Szüts, Z. (2018, September). The Role of Chatbots in Formal Education. In 2018 IEEE 16th International Symposium on Intelligent Systems and Informatics (SISY) (pp. 000197-000202). IEEE.

Patton, M. Q. (2015). Qualitative research and methods: Integrating theory and practice. Thousand Oaks, CA: SAGE Publications.

Popovici, A., & Mironov, C. (2015). Students' perception on using eLearning technologies. Procedia-Social and Behavioral Sciences, 180, 1514-1519.

Serban, I. V., Sankar, C., Germain, M., Zhang, S., Lin, Z., Subramanian, S., ... & Rajeshwar, S. (2017). A deep reinforcement learning chatbot. arXiv preprint arXiv:1709.02349.

Shawar, B. A., & Atwell, E. (2007, January). Chatbots: are they really useful?. In Ldv forum, 22, 29-49.

Stathakarou, N., Nifakos, S., Karlgren, K., Konstantinidis, S. T., Bamidis, P. D., Pattichis, C. S., & Davoody, N. (2020). Students' Perceptions on Chatbots' Potential and Design Characteristics in Healthcare Education. Studies in health technology and informatics, 272, 209-212.

Statista (Jul 11, 2018). Acceptance of artificial intelligence chatbots by customers worldwide, as of 2017, by service. Retrieved from: https://www.statista.com/statistics/717098/worldwide-customer-chatbot-acceptance-by-industry/

Thies, I. M., Menon, N., Magapu, S., Subramony, M., & O'neill, J. (2017, September). How do you want your chatbot? An exploratory Wizard-of-Oz study with young, urban Indians. In IFIP Conference on Human-Computer Interaction (pp. 441-459). Springer, Cham.

Turing, A. M. (2009). Computing machinery and intelligence. In Parsing the Turing Test (pp. 23-65). Springer, Dordrecht.

Verleger, M. & Pembridge, J. (2018). A Pilot Study Integrating an AI-driven Chatbot in an Introductory Programming Course, IEEE Frontiers in Education Conference (FIE), San Jose, CA, USA, 1-4. DOI= 10.1109/FIE.2018.8659282

Yan, M., Castro, P., Cheng, P., & Ishakian, V. (2016, December). Building a chatbot with serverless computing. In Proceedings of the 1st International Workshop on Mashups of Things and APIs (pp. 1-4).

Yi-Chieh, L. & Wai-Tat, F. (2019). Supporting peer assessment in education with conversational agents. In Proceedings of the 24th International Conference on Intelligent User Interfaces: Companion (IUI '19). ACM, New York, NY, USA, 7-8. DOI=10.1145/3308557.3308695

ZEMČÍK, M. T. (2019). A Brief History of Chatbots. DEStech Transactions on Computer Science and Engineering, (aicae).