REVIEW OF USAGE AND POTENTIALS OF CONVERSATIONAL INTERFACES AT UNIVERSITIES AND IN STUDENTS DAILY LIFES

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Abstract

The continuous advancement of digitization extends beyond educational institutions, giving rise to numerous innovations, particularly in the realm of study information [1]. One avenue for incorporating digital methodologies involves leveraging conversational agents (CAs) [2], serving as interactive interfaces bridging the gap between humans and computers. In the broader context, conversational agents are gaining prominence, offering several benefits to their users. The overarching goal is to comprehensively assist users through these intelligent systems. Consequently, exploring existing university chatbots becomes imperative to discern the areas where they excel. This research aims to scrutinize diverse chatbot systems, delving into their use cases and the challenges they encounter, employing a systematic review. Here it turns out that chatbots support universities the most in the fields of administration, e-learning and mental health. Furthermore, the study will investigate practical experiences on the potential applications and implementation of these systems in university settings, incorporating insights from an online survey and interviews, both made with experts. Here it comes to conclusion that preparation in relation to a chatbot implementation is the key factor to success. Otherwise, a failed system is nearly impossible to be saved, once users lost trust in the system. Therefore, carefully made preparations in the technical and organisational field are necessary to provide a helpful assistant.

Motivation

The ongoing progress of digitization does not stop at educational institutions and is producing numerous innovations that are noticeable in the area of study information [1]. One way of implementing digital methods is the use of conversational agents (CA) [2], which act as an interactive interface between humans and computers. These CAs are often implemented in the form of chatbots. The use of chatbots as part of student information processes brings with it the potential to improve the accessibility of general information and to automate the management of user requests. This allows employees to focus more on individual problems. However, a lack of appropriate answers or even making false statements can lead to negative feedback from users. The workload of maintenance of these systems must also be considered. In general, speech and text-based CA are on the rise and bring several advantages for their users. These intelligent systems shall support their users as comprehensively as possible. Therefore, it is worth taking a look at different chatbots that are already used at universities to discover, which topics can be served properly. This paper will examine the various types of chatbot systems, their specific requirements and obstacles utilizing a systematic review. Furthermore, this paper will explore their potential application and implementation at universities through an expert interview.

Method

First, a structured literature review is carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standard to show the current state of research on chatbots at universities in the prevailing literature [3]. The focus is on the identification of potential areas of application for chatbots at universities. Several databases were referenced to ensure a comprehensive investigation. These databases comprised IEEExplore, Scopus, and ACM Digital Library. The employed search term is denoted as follows:

> *TITLE-ABS-KEY((chatbot* OR "conversational agent*") AND (universit* OR "higher education"OR student*) AND (("e learning "OR elearning OR "online learning") OR (faq OR organization OR administration OR "administrative process*") OR ("mental health"OR "mental well-being"))) AND PUBYEAR>2012 AND PUBYEAR<2024*

After gradually identifying relevant keywords, 364 papers were retrieved using the above-mentioned search term, of which 159 were judged to be relevant. A further 35 relevant papers were identified through a forward search, meaning that 194 papers were eligible for further evaluation. Of these, 39 papers were initially sorted out due to incorrect focus on content, 10 Paper were inaccessible and 3 could not be reviewed due to language barriers (Portuguese, Turkish). The remaining 136 papers accounted for 13.5% in the area of mental health, 58.5% in the area of e-learning and 28% in the area of administration. These possible areas of application extend across the entire student life cycle, which is explained in more detail in the next section.

Student Life Cycle

Various possible applications for chatbots at universities have been identified in the literature, which extend across the entire time span of being a student. This so-called student life cycle (SLC) describes the academic career that every student goes through, see Figure 1, and can be divided into several phases [4][5]. In the following, upcoming problems in each phase are described and in the chapter afterward, several papers from the above-mentioned literature review are cited to provide examples for the different use cases. Nevertheless, in the literature there can be found even more.
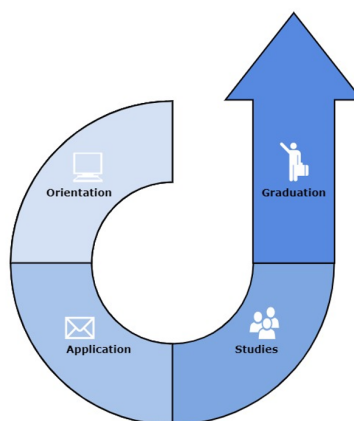

Figure 1 – Student Life Cycle

Use Cases in SLC

Orientation Phase In the first phase, prospective students start collecting information about universities and courses, as well as universities themselves start recruiting new students via information events. On one hand, students try to collect information about different universities and courses to decide about where to study, on the other hand, universities reach out to potential students and try to promote their university. Therefore, information needs to be easily accessible, but also independent of time and location as especially international students aren't able to visit local events or consult offices at their opening times, due to time shift and distances from their home. Information presented on university websites is often difficult to find and also not always translated to the native language of the user, which can create an additional language barrier.

Application Phase During the second phase, students actively start their enrollment at a university, when the bureaucracy as well as the complexity of the enrollment process can be quite a burden. Therefore, it often takes a certain amount of time to fill out all the necessary forms and yet mistakes are still made. It is also not always clearly visible, how the enrollment process will proceed exactly and afterward, potential students are waiting for further updates on their application status.

Study Phase The third phase covers up the whole time span of a students life while being at university. Not only actions related to study administration and teaching, but also non-university topics from students' everyday lives are considered. Students are confronted with numerous unknown things like new environments and people while having to deal with tasks like creating study plans, getting organized with lectures and other events, the registration of exams or house works and interacting with different institutions of the university. The amount of new challenges itself can be quite incriminating and overwhelming for new students wherefore it is necessary to provide students with easy access to information on how to deal with such tasks. Otherwise, this mental load can effect the whole study performance negatively, which leads to less good grades or in the worst case, to a cancellation of the study. Additionally, in comparison to their time at high school, the way of teaching also takes a change, as the students are mostly on their own when it comes to studying new topics and the direct care through a professor or tutor is not guaranteed. Therefore, the demand on alternative study support is given, as well as the demand for supporting students in the administrative processes in universities. It can be useful as well to provide information and offerings besides the campus life, like sport plans, student initiatives and interesting points of the local surroundings to help students find their way in their new surroundings more easily so that they can focus on their study.

Graduation Phase The fourth phase extends beyond the time after graduation. Students face new challenges as their final exams and the stress coming along with them. Here they need to be provided with appropriate tutoring as well as mental support. They also need to focus on what comes after their study and are confronted with questions like whether they want to continue with another study or where to apply for a job. Offerings like career counseling can help students find their way out of university. Universities also try to keep connected with their graduates and reach out to their former students with alumni events and special offerings for post-graduates. As students tend to change places after finishing study, these kinds of information needs to be provided independently of time and location again.

Chatbot Solutions

For the above-mentioned Problems, intelligent and speech-based assistants such as chatbots can be used to provide help. In the following table 1, there will be presented examples from the

literature review on how chatbots are already used as a solution.

SLC phase	problem/use case	feature/chatbot support	literature
orientation phase	providing information	• inform about the university, course offerings and aptitude tests • most likely through a FAQ	[6] [7]
	deciding what course to study	• study counseling to recommend courses based on personal interests and strengths	[8]
application phase	dealing with bureaucracy	• guiding through the application process the reduce time efforts and mistakes made in when filling out forms	[9]
	barriers in time, place and language	• providing a multilingual dialog system that is accessible at any time from all around the world in multiple languages • also easily understandable for people with disabilities	[10] [11]
study phase	orientation for first semester students	• answering frequently asked questions about study and university • providing features for map supported navigation on the campus to find buildings or lecture rooms	[7]
	course plan creation	• support through information about necessary and optional courses together with time plans	[12] [13]
	lectures and exams	• providing information about available lectures, exam plans and deadlines • supporting through the process of exam registration and housework delivery	[14]
	mental support	• recording the current health status of students through questionnaires or free dialogues according to established standards • presenting strategies to manage stress or other psychic diseases • referring to therapeutic treatment options	[15] [16] [17] [18]
	lecture support	• visual and text-based presentation of content from lectures and exercises • various curses and topics can be served	[19] [20] [21] [22] [23] [24] [25] [26] [27]
	online tutoring	• dialog-based learning trough calling up students knowledge • training with questionnaires • helping with finding groups to study together with other students with or without the chatbots interaction	[28] [13] [29] [30]
graduation phase	career counseling	• giving job recommendations based on personal skills, received diplomas and preferred location	[31]
	mental support	• helping students to manage stress, anxiety and insecurities regarding fears of the future	[15] [16] [17] [18]

Table 1 – Use cases for chatbots in the SLC

Survey and Expert Interviews

To examine the theoretical knowledge about the usage of chatbot as support in the student life cycle into practice, an online survey was made. This survey consisted of open questions covering different topics regarding chatbots in universities, see table 3. The survey was send to professionals with expertise in the field of chatbots at universities, either because they research on this topic or work an implementing chatbot systems, from whom eight participated. Here it needs to be stated, that the survey has a quite subjective character, for the small number of participants and because the answers only based on personal experiences.

topic	answer categories
use cases	study support, administrative processes, application process
additional functions	personal references, small talk, help during use, everyday information
benefits	user, publisher
assistant comparison	chatbot, human
assumed opinions	students, staff
technical preparations	database, bot design, data security, long-term considerations
organizational preparations	personnel planning, organizational tasks, maintenance, data security
risks	content level, technical level
borders	content level, technical level
data security problems	data processing, transfer to third parties, users worries
data security solutions	formel level, juristic level, technical preparations
negative effects	user level, publisher level, technical level
solutions for negative effects	preparations, during use
success factors	application level, positive effects

Table 2 – Summary of the online survey

For evaluation, the answers were summed up into larger categories as shown in table 3. Afterward, the results were presented to two experts in personal interviews, where one had a research and the other an industrial perspective. The interviewed experts were asked to rate the collected answers from the survey regarding approval or rejection, or rank the answers regarding relevance while making use of their previous experiences and knowledge. It could be seen that generally there were two options when the assessments of the experts got compared: either both of them had the same opinion about how to rate or rank the answers from the survey, or their opinions were opposite directions. This can be explained by their different experiences in the field of and standpoint on chatbots: While *expert A* works a professor for many years, *expert B* was a young man, not many years apart after graduating, working in the field of chatbot implementation.

For the topic of use cases, *expert A* sees a lot of potential for chatbots used in the application process and ranked study support as least important, while *expert B* stated the opposite way. Both agree that for additional functions, the help during use and personal references are more important than small talk and everyday information. Both state the work relief for employees as the most beneficial effect of a chatbot, followed by a 24/7 reachability, higher efficiency and individual information. Furthermore, both agree on the time factor being the main reason for people to use chatbots instead of interacting with human assistants. Bad design and responses, as well as lack of individuality and bad experiences, were stated main reasons against the use of chatbots. *Expert A* states that curiosity from students to use alternative forms of gathering information is high in general, but the expectations of the system need to be adjusted. In addition, *expert B* states that students are sensitive to bad implementation. For *expert A*, employees from university mainly focus on the functionality of chatbots. Both agree that test scenarios should be made before the official launch of a chatbot system to rule out errors and to eliminate prejudices.

When it comes to preparations for a chatbot implementation, both experts agree that all categories of technical preparations need to be considered for a successful implementation.

Especially long-term considerations are particularly important in their opinion. For organizational preparations, *expert B* thinks of personnel planing as the most important factor, especially with regard to the ongoing use. Here *expert A* states long-term preparations and maintenance as the least important points while he would prioritize organizational aspects. For the problems, both expert expects technical issues to be the most serious. But while *expert A* states ethic and juristic use cases to be hard borders for chatbots that can't be solved soon, *expert B* sees potential in these points, but states personal consultations to be hard borders, which constitutes no problem for *expert A*. Regarding the topic data security both experts agree on all three problem categories that need to be taken seriously. Especially solutions as anonymization or pseudonymization, a data protection and other disclaimers regarding the data processing need to be implemented. Otherwise, peoples skepticism whether their data are safe or not can lead to refuse of using a chatbot.

When it comes to a poor implementation, the negative effects coming from the user level are the most severe problems in the opinions of both experts. In this case, they state that only setting up a complete whole system, running with a new name and interface, can give the chatbot a chance to get accepted again. If users once gain severe negative experiences, it mostly means an irreversible rejection of the chatbot system. Therefore, both experts state extensive preparations, for example by using usability engineering, to be necessary to avoid such severe problems. In the end, to measure the success of a chatbot assistant, both experts agree on positive user experience to be the most meaningful success factor and see successfully answered questions as well as a decrease in working effort for employees as important and also measurable success factors as well.

Conclusion

The entire paper discusses the outcomes of the PRISMA literature review and classifies sources according to the SLC to highlight common features of chatbots. The literature research revealed many use cases for chatbots at universities. Meanwhile, a survey and interviews were conducted among experts who have expertise in the field of developing and implementing chatbots. In this process, problems and hurdles associated with use were also uncovered and it presents lessons learned. After evaluating this survey, recommendations for action can be extracted. Moreover, it connects the recommendations to the development process of dialog systems.

These results can also be reproduced on other dialog systems, as for example a chatbot could be replaced by a voice assistant. It is to be assumed that these kinds of intelligent systems will be able to be used as a solution for problems and hurdles in the SLC as well, and that similar preparations need to be taken into account to implement a successful assisting system.

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