ABSTRACT
In the course of their studies, the majority of students at German universities have to write a certain number of academic assignments as an essential part of the academic training in any degree program. This work presents some initial results of our research into the design, implementation and conceptual usage of OKI (Open Knowledge Interface) – a digital assistant intended to support students in writing academic assignments. The core aspects of assistance include project management, context-sensitive help in applying scientific methods and search in open access literature. OKI is a conversational chatbot running inside Telegram-Messenger and allowing an efficient mobile usage, and thus a flexible way of organizing users' own time and workload. The Open Knowledge Interface project is funded by the German Federal Ministry of Education and Research within the Open Access Guideline, and runs from May 2018 to October 2019. This paper therefore is an attempt to describe some initial conceptual thoughts as well as preliminary results including first user experiences and a brief outlook on future work.

CSC CONCEPTS
• Human-centered computing → Natural language interfaces;
• Applied computing → Computer-assisted instruction; Interactive learning environments; E-learning; • Computing methodologies → Natural language processing.

KEYWORDS
Digital assistant, Chatbot, Open access, Literature search, Academic assignment

1 INTRODUCTION
In the course of their studies, the majority of students at German universities have to write a certain number of academic assignments as an essential part of the curriculum in any degree program. This is basically a good practice, since the knowledge and application of scientific methods both enable a structured form of knowledge acquisition in general which is not only used within specific scientific organizations, but is helpful throughout modern working life. It is therefore particularly regrettable that students often torture themselves through their academic assignments in order to eventually receive a degree, without recognizing the immense advantages of the scientific approach in its own right. It is not unusual for a student to face trouble in coping up with the pressure of maintaining the high standards of requirements within a short time frame.

The concept of OKI – a conversational chatbot (see section 2) to support students in their academic work – presented here, addresses several issues, namely:

• Students do not work continuously on their assignments.
• The teaching of scientific methods does not occur when knowledge is needed.
• Students write alone and have only limited access to their supervisor(s).
• While performing literature search, due to the ever-rising information flood and insufficient research skills, students are often unable to find and use enough relevant scientific literature.

The selection of the issues addressed is based on the experience of the project initiator as a university teacher and a long-term supervisor of a variety of academic assignments. Another reason lies in their general solvability with the use of a digital tool. Of course, there are many other problems, such as the lack of motivation which must be addressed in other ways, for example through dedicated supervisors and under the active use of the academic grading. A digital assistant like OKI should be regarded as a useful supplement to traditional teaching methods and can only be part of a holistic educational approach.

In this sense, the Open Knowledge Interface (OKI) presented here subdivides the scientific process (from finding a research topic through the submission to the reflection of results) in individual tasks and promotes a consistent and continuous way of working.

OKI is a research project at the Berlin School of Economics and Law in Germany. The project runs from May 2018 to October 2019. OKI is still in development by the time of writing this paper.
with a prototype version running and currently being evaluated, so that presenting and discussing it on EASEAI 2019 will provide valuable stimulus for the further development and improvement of the digital assistant.

2 STATE OF THE ART
A chatbot is a computer program that processes natural language input from a user and generates smart and relative responses that are then sent back to the user [12]. Initially, when chatbots were developed primarily for entertainment (the most well-known examples are ELIZA [17] and A.L.I.C.E. [16]), their main purpose was to simulate a human conversational partner as close as possible. Over time, the focus of chatbot design moved from perfect mimicry to creating useful tools that help users to accomplish everyday tasks in various fields using natural language interaction. The developments in artificial intelligence and natural language processing have made it possible to create self-learning digital assistants. Thanks to continuous training and the analysis of user input, a chat-enabled digital assistant can respond to different requests in a context-based manner and provide appropriate answers. The following examples only show some important trends and applications of chatbots across various areas.

2.1 Chatbots – Some Examples of Use
Today, chatbots offer a wide range of application possibilities: they are no longer used just for replying customer inquiries; they can be used wherever communication with people is important. Apart from the classic use in customer service (e.g. [3]) or as shopping assistants (e.g. [2]), they are now increasingly used in human resources departments, where they can answer frequently asked internal queries or carry out processes like assessing employee performance and going through appraisals, while offering support in the actual selection process of job applicants [11]. In the area of business intelligence, they can quickly provide the user with relevant data for supporting and improving the decision-making process. Project management tasks can be much more efficient and productive with the help of digital assistants, e.g. automatic reminders for upcoming appointments or setting the times for meetings [1].

In libraries, the use of digital information assistants has been an increasingly observable trend for years [6]. One of the most popular German-language examples is Stella – the friendly library assistant on the website of the Hamburg State and University Library, who provided information literacy, helped with literature search and explained access conditions to electronic full-texts in the years 2004 to 2015 [5].

2.2 Chatbots in Education
The progress of the chatbot technology made the use of chatbots in a university context possible. Enrollment issues, student support or campus services – the possible fields of application are numerous. Chatbots provide a cost-effective and simple way to facilitate information access and streamline processes. A good example is described in [9].

Due to chatbots’ communicative ability through natural language and the high popularity of chat messengers among the young generations, chatbots are believed to have a significant educational potential. They are increasingly finding their place in the actual higher education process: a remarkable example is the Jill Watson experiment [10], in which the natural language interaction with the chatbot on study-related topics was so convincing that the students did not recognize it for months, that Jill was not a real person, but the first AI-based teaching assistant.

A combination of some organizational, teaching and project management capabilities is integrated into the Deakin Genie app [8]: the intelligent helper uses the IBM Watson AI system to answer questions from different areas of campus life.

A digital tool supporting scientific work in the broader sense, and in particular the (automatic) search for peer-reviewed publications in publisher web portals, is presented in [13].

To the best of our knowledge, there are no other solutions of this kind published in the open literature. Accordingly, the idea of integrating project management features, online literature search and context-sensitive tips on scientific work, as described further in this article, is a novel and helpful solution.

3 OPEN KNOWLEDGE INTERFACE
3.1 Educational Goals and Objectives
One of OKI’s educational goals is to encourage students to work on an assignment in a continuous, goal-oriented manner, in contrast to the so-called binge writing, where large parts of the work are usually written shortly before the deadline. For students, this educational goal is not always easy to implement. Ideally, they would be greatly facilitated by using OKI and thus – ready to change their writing behavior.

Another goal is to teach students to treat an academic assignment as a (small or a larger) project – working efficiently on a project and developing a project management and self-organizing skills are both crucial throughout modern working life.

And last but not least: OKI attempts to encourage students to conduct a comprehensive literature search. The main focus is placed on the active review and evaluation of abstracts. The students should rely less on rankings of literature search engines and evaluate actively themselves, assuming that a good preselection of scientific literature leads in effect to the use of more relevant sources.

An educational framework for this low-threshold and concurrent but consistent and continuous behavior influence is the concept of nudging [15]: By supporting and reinforcing positive behavior, students are "pushed" rather than "forced" in a desired direction.

3.2 Technical Environment
OKI is a chatbot, integrated in Telegram messenger [14] which serves as a front-end application. Calling some functionalities, such as creating a new project, is done by either using the Telegram command syntax, e.g. /newproject or a natural language input, e.g. "Create a new project" or "I would like to start a new project". However, for certain functionalities requiring a larger screen view, a chat interface is not an optimal solution. For these cases, OKI uses Java Script-based web pages that are called up from within the chat.

The OKI server is mainly programmed in Node.js. The data is stored in a MongoDB database. The functionalities can be called up
both reactively (upon a user request) and actively, auto-scheduled by means of a cronjob. The natural language processing is done using Rasa [4]. The stack for speech recognition includes Scikit-Learn, Spacy and Python in addition to Rasa. Currently, the following Open Access Databases are connected: DOAJ (Directory of Open Access Journals), SpringerLink and EBSCO. OKI uses a consistent format to store the literature sources found.

3.3 Features

3.3.1 Project Management. In order to use OKI, students first create a project for their academic assignment by setting a project name, selecting a project type, and entering a starting date (Fig. 1). From this point onwards, OKI has the necessary information to remind the user of upcoming tasks and provide context-sensitive help and support. For each project, OKI creates an appropriate project schedule, based on a specific template (Bachelor’s thesis, Master’s thesis, academic essay etc.). At the beginning of a project, however, students are offered the option to adapt the automatically generated project plans: on the one hand, to make them as accurate as possible and, on the other, to encourage students to actively engage with the scheduling process.

3.3.2 Reminders and Context-Sensitive Hints. Reminders and context-sensitive hints are sent as Telegram messages. In addition to the text, the integration of any hyperlink-accessible information (images, voice, video etc.) is possible. It has been a didactical challenge to provide complex information that fills several pages in textbooks, in the form of a (very) short chat message. A good solution here has been the use of short explainer-videos, giving basic information about a particular topic.

3.3.3 Search Terms. A central function of OKI is the literature search in open access databases. To conduct a background literature search, OKI needs pre-defined search terms (Fig. 2). This can be done in two ways: either the user is actively reminded by the digital assistant to enter the search terms on a particular date (according to the schedule) or the user can initiate the input or change the previously defined search terms at any time by using the chat interface.

3.3.4 Scheduled Background Literature Search. OKI searches on a daily basis for new articles in the on-line databases used and provides information on possible findings. The search terms are continuously updated based on the user’s preferences.

3.3.5 Viewing Abstracts. OKI offers a user-friendly and mobile-optimized view of article abstracts, in addition to a text-to-speech function (Fig. 3). The user should be able to quickly sort out as many abstracts as possible in order to find and select potentially interesting sources. Currently, the sorting of a pre-selected bibliography list is based on relevance and up-to-dateness, whereby the relevance results from the number of search terms used and found.

3.3.6 Bibliography. The bibliography contains the titles of the articles marked by the user as well as links to the full contributions. A great advantage of open access is that a user can view the full articles without authentication.

3.3.7 Project Template Management. The project templates, e.g. Bachelor’s thesis, academic essay, Master’s thesis etc., are currently written in JSON scripts which are stored in the MongoDB database. In addition to the pre-defined template tasks for each project type, it is possible to directly enter user-defined tasks, for example to add fixed deadlines into the project schedule.

4 CONCLUSIONS AND FUTURE WORK

An early prototypic version of OKI was tested by a small group of 13 students in a controlled environment. Currently, this test is being repeated by 32 students using a more advanced version of
further developments. Several examples are given below: However, even after that, there still will be a huge potential for and extensions planned will be completed within the project term. through about three-fourths of its planned duration. Some changes adding some useful extensions.

Future work includes improving the current features and use and the student’s requirements regarding an educational digital students helped us in gaining some first insights into the willingness of the concept of OKI is found to be of help. There are still many improvements to be implemented (e.g. regarding the relevance of literature sources found or the natural language processing) to match the desired educational concept.

Nevertheless, testing the prototype among a small sample of students helped us in gaining some first insights into the willingness of use and the student’s requirements regarding an educational digital assistant. Future work includes improving the current features and adding some useful extensions.

By the time of writing this paper, the OKI project has gone through about three-fourths of its planned duration. Some changes and extensions planned will be completed within the project term. However, even after that, there still will be a huge potential for further developments. Several examples are given below:

- OKI can be used to support lecture materials. Specifically, instead of literature search, the presentation of lecture material divided into small mobile-optimized sections would be the focus.
- Another expandable feature is receiving feedback: this will help students to keep track of what they have already accomplished and what is still to be done. This kind of feedback can also be extended to include game elements.
- Offering a platform for project templates in OKI, where supervisors can create or edit project templates according to the needs of their particular subjects, would be a further extension option. At the same time, this would be a good way to dynamically expand the functionalities of OKI.

At present, OKI may only be used by German-speaking students. An English version of the tool is planned, thereby making it accessible to a wider user community.

These are only some of the numerous extensions possible. In this paper we have presented our concept of a digital assistant, who actively addresses students and helps them to successfully complete a writing assignment. This active component is becoming increasingly important in the attention economy and can be of help across different areas of education.

Ideally, OKI would not only be useful in every-day student life, but would also teach students some vital skills, helping them learn how to work on a project, self-organize, write consistently, meet deadlines, analyze lots of literature sources carefully and, of course, write academically on a high quality level. This is an essential contribution towards supporting the acquisition of scientific skills in a digital age, where learning needs to be mobile, flexible and more adaptive.

REFERENCES


\footnote{Attention economy is an approach to the management of information that treats human attention as the scarcest resource in today’s information-flooded world.}