



How can Artificial Intelligence Improve the Academic Writing of Students?

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Abstract

The acquisition of academic writing skills is an essential part of higher education [1,2]. Across the disciplines, it is evident that students have a high demand for inductive and support services for methods of scientific work [3]. Due to the increasing number and the growing diversity of undergraduates, students tend to receive less one to one support or individual supervision when writing their thesis [4,5]. In turn, this worsens the situation and leads to a poor scientific education and reducing motivation of the students. In our paper, we would like to address this problem and present a technology-supported solution to improve students' academic writing. Our research idea is to develop new learning settings with the assistance of an AI-supported text generator, which helps students improve their writing skills without having to be dependent on a high level of mentoring by their professors. The implementation of the project will take place in Academic Writing Courses at multiple Graduate Centres within Germany.

Keywords: text generator, artificial intelligence, AI-supported learning, higher education, writing skills

1 State of Research

In Germany, rising student numbers and the increasing diversity of students do not correspond to more chairs or additional teaching staff in the domain of scientific writing. Hence, these two recent issues in the field of post-secondary education both have an immediate impact on the quality of supervision. However, it is a major goal of each study programme to enable students to write scientific papers. Therefore, this issue is relevant for higher education.

According to a nationwide representative study by the German Centre for Higher Education Research and Science Studies, university students face difficulties when writing papers. 25.7 % of this sample report great difficulties. More than a quarter of all the respondents (30.4%) rate existing introductory courses on methods of scientific work as not particularly useful for their studies [6]. Besides, university teachers rate their students' overall academic writing skills as rather low [7]. Especially students who must overcome linguistic barriers due to a different native language face difficulties. Similarly, students of the STEM disciplines, who are barely ever confronted with the writing of academic texts during their studies, face severe problems with the complex task of academic writing [3].

In our project, we would like to use an AI-supported tool to improve the writing skills of students. Our overall goal is to make it easier for a broad variety of students to write academic texts. The use of AI in educational contexts is increasingly coming into focus in many countries, including Germany [8]. In particular, the United States of America, Japan, China and Australia are taking on 'pioneering roles' in the use of AI in universities, colleges, and schools [9].

In 2020, the use of AI tools has already been put into effect in a host of post-secondary teaching settings [10]. Germany's very latest examples of application in this sector include the analysis and prognosis of learning analytics, the elaboration of individual learning offers, and the development of machine learning tools [11]. Where AI is combined with highly individualized learning paths and new forms of self-education, new possibilities of automated analysis and evaluation of learning processes and of teaching improvements open up. However, new fields of problems and research questions also arise: besides implementation issues, new ethical, social and cultural-technological questions arise, which partly go far beyond singular subject perspectives.

There are also some recent attempts to support students in writing scientific papers using AI-based technologies. One example is the Thesis Writer, developed at Zurich University of Applied Sciences in Switzerland [12]. Technologies like these are usually trained to review texts primarily for grammatical or syntactic mistakes and are not used to inspect semantic aspects of language use (such as coherence, argumentation structures, pertinence etc.). Neither do they focus on supportive issues, such as the development of writing strategies, for instance. Semantics and contextual writing support are of high relevance when it comes to writing a well-composed and well-informed academic text. Currently, AI tools do not provide that kind of assistance yet [13].



2 Realization

In a first step of the project we would like to conduct a pilot study on the use of AI-based text generators in connection with the improvement of writing skills of students using the text generator language model GPT-2 from the OpenAI developer team. This text generator is freely accessible and is considered market-leading in international comparison. The GPT-2 text generator is able to formulate meaningful text on various topics using an AI-supported text database.

With this AI tool, users can write the beginning of a sentence in a text field and the AI text generator will continue writing a paragraph one word at a time on the topic addressed. Their language model contains 1.5 billion parameters, trained on a dataset of 8 million web pages. The tool predicts the next word, given all of the previous words within some text. We would like to use this technology for educational scenarios in the university context to help students improve their writing skills.

The main research question of the pilot study is to what extent students acquire a writing competence with the help of the AI tool, which enables them to meet different writing occasions in their studies with a basic knowledge and ability, even with a low degree of supervision by professors. For this research purpose, we will conduct an educational technologists' research project on teaching by the use of AI within the graduate centre of up to eight leading German universities. We will build upon an innovative approach towards teaching scientific writing that has been implemented in these universities [14].

Our first step will be to implement the text generator in our local context and to integrate it into a new online-course on scientific writing. Students will work on a text proposal on a topic of their choice. They insert a few lines of text into the tool and it will continue their writing. As a next step, they will check for stylistic issues, verbose style or inconsistent argumentation and improve the text according to the standards of academic writing. While editing the text, the Artificial Intelligence assesses improvements instantly making the writing process a joint effort. Lecturers provide feedback on the final version of the text which is also provided to the AI. By improving the AI-based writing assistance, students learn to take the professor's perspective and can better anticipate how a good academic text should be structured, and which mistakes should be avoided. In addition to improving the writing skills of students, a further aim of the project is to inspire students for technology-supported learning without losing a critical view on AI. Through the creative approach, students experience technology-supported learning as active participation, in which AI has a stimulating and participatory but not a controlling function. To give students an insight into AI from as many perspectives as possible, the project will also discuss critical aspects of AI-supported learning.

The teaching setting is illustrated here with the help of a fictitious person:

Kira, 20, is studying communication sciences at a German university. She has to write her second essay this semester, after barely passing the first one. Her supervisor had to combine several students into one advisory group because their cohort exceeds the teaching capacity. He answered her questions mainly by referring to an introductory book he had written 15 years ago and which she finds quite difficult to understand. Due to her negative experiences, she is very much afraid of scientific work. Kira has hardly any experience in scientific work and she never felt easy with writing assignments. Back at school she was told at several occasions, she did not have the 'talent to write'. Especially, she finds it difficult to take up the writing process.

Kira's problems are: 1. little knowledge of scientific work, 2. bad previous experience, 3. fear of bad grades and fear of failing again, 4. writer's block, 5. little motivation/interest in scientific writing. Kira uses the AI-supported text generator to obtain information on a topic of her choice. She checks the text section in a digital writing tool for stylistic errors, unclear formulations as well as illogical argumentation chains. By applying her corrections, she improves the text according to criteria of scientific work she had received in an online session before. After completing the first revision of her draft, Kira decides that scientific staff should evaluate her corrections and give her feedback and further advice on the manuscript. The AI-text generator accordingly solves the following mentoring and supervision problems: 1. overcoming the fear of writing, 2. solution of writer's block by the text generator, 3. developing an understanding of poor formulations and illogical argumentation chains, 4. developing an understanding of well-written scientific texts 5. development of motivation/interest in scientific work.

3 Following Steps

After the pilot study, we will cooperate with computer scientists who have expert knowledge of the GTP-2 language model. Our cooperation's goal is to apply the model to a German-language text generator which will help students in different learning environments to improve their writing skills.

The outcome of this long-term project is a research-based learning environment that combines pedagogy and technology to support the development of academic writing skills - in relation to the

demands of different research disciplines. Fields of application offer a variety of scientific writing occasions and situations, ranging from a student's mail requesting a topic, to drafting a thesis, study, exercise, and poster texts, articles, or even research proposals.

In order to promote basic writing skills for science, the pedagogical-technical learning environment is aimed at (1) students who can use the learning environment for self-learning, (2) teachers who can integrate the learning environment into their own courses, and (3) writing centres which can use the learning environment to support academic teaching.

4 Conclusion

The focus of our project is to significantly improve the writing competence of students with the help of technological learning and to reduce the workload of professors in supporting scientific writing. At the same time, we believe that our project has found a way to integrate AI into an academic learning setting, in which AI does not have a monitoring or controlling function. Through this change of perspective, students experience a rarely considered type of technology-supported learning and experience participation and activation through the AI text generator.

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