META-COGNITION ON AI:
WHAT STUDENTS THINK ABOUT USING AI FOR ACADEMIC PURPOSES

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Abstract
There is currently a broad debate concerning the application of AI-based tools in academic contexts, particularly in the domain of academic writing of students, as well as concerning the AI-related skills necessary for these pursuits (cf. Long & Magerko, 2020). The utilization of Generative AI (genAI), underpinned by Large Language Models (LLM), holds considerable promise in facilitating academic processes, particularly for students to whom the language of academic study is not their native language. A cross-sectional survey of students at German universities (von Garrel & Mayer, 2023) revealed that approximately two-thirds of respondents were already using genAI-based tools in the 2022/23 winter term, but only a quarter did so (very) frequently. Similar studies have primarily yielded a series of discrete snapshots of genAI utilization in academia. A notable limitation of these studies is the absence of any distinction between L1 and L2 students. The survey we conducted focuses on potential group differences between students with German as L1 and German as L2 and also aims to track developments in the use of tools based on genAI, knowledge about genAI, and attitudes toward genAI in the first years of the general availability of genAI-tools (2023-2025). To this end, a total of 143 questionnaires from students of various degree programs (primarily German as a Foreign and Second Language) from the University of Leipzig encompassing a period of two years are evaluated. The results of the survey presented in this paper concentrate on the students' awareness of and disposition towards genAI / LLM (but see Ketzer-Nöltge & Rüger, in press, for complementary results).
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1. Introduction
Shortly following the release of ChatGPT by OpenAI in November 2022, Kasneci et al. (2023) pointed out the numerous opportunities presented by Large Language Models (LLMs) for educational applications in a position paper. They listed a wide range of potential applications for

academic work at universities. The authors also explicitly mention the considerable opportunities for dealing with (foreign) languages in higher education and for disadvantaged student groups. The new opportunities for empowerment, particularly for students with (German as) a second language (L2) or from educationally disadvantaged backgrounds, were also the starting point for the study presented in this article. The utilization of Artificial Intelligence (AI) in educational settings, assessments, and research endeavors has been a subject of intense debate, often accompanied by considerable skepticism (see, for instance, Dwivedi et al. 2023). However, the question arose as to whether and how students with L2 German, in particular, would actually understand and use the new (generative) AI tools as a support. In order to take this into account in our teaching and to be able to provide meaningful impetus, students in selected seminars at the Herder Institute of the University of Leipzig were surveyed from the summer semester of 2023 to the winter semester of 2024/25 about their assessments, insights, and actual use of generative Artificial Intelligence (genAI) in their studies. For the majority of the students surveyed, German is not their native language and they attended seminars to enhance their academic language skills in German. A particular emphasis was placed on potential differences between students with German as their L1 and L2. Consequently, this study is also regarded as a contribution to the empirically supported implementation of AI in study and teaching from a diversity-oriented research perspective (cf. Gottburgsen, Hofmann, & Willige, 2023, p. 138). Furthermore, the survey was administered repeatedly at various points in time to address the necessity for longitudinal studies.

In the following, we first present the relevant theoretical and empirical foundations. It is on this basis that we derive the specific research interest and research questions.

1.1. AI usage in academic contexts

In recent years, numerous studies have examined how often and for what types of tasks students use genAI based on LLMs. These studies often consist of large-scale quantitative surveys with several thousand participants (cf., e.g., von Garrel & Mayer, 2023). Most studies report a relatively high number of students using genAI in their studies, and some have shown significant increases over time between studies. This suggests that using genAI in academic contexts is becoming more common (cf. Freeman, 2024). However, the student surveys on AI use up to 2024 could not yet identify regular, intensive, and broad use for a wide range of academic tasks. Different levels of usage were observed, especially among different academic subjects: GenAI usage was particularly prevalent among computer science and mathematics students (cf. Hüsch et al., 2024).

A study by Wulff, Häusler, and McGury (2024) compared students for whom German was either a first or second language, as well as students from German- and non-German-speaking countries. From November 2023 to January 2024, the authors surveyed a total of 192 students of German Language and Literature / German as a Foreign Language. The number of L1 and L2 students was approximately balanced. The authors found relatively minor differences between the two groups regarding AI use (e.g., ChatGPT usage: 64% for L1 vs. 66% for L2 German). Additionally, there were hardly any differences between the language groups regarding the goals and concerns for genAI usage or the students' assessments of problematic aspects regarding this usage.

In the survey study presented in this paper, students with German as L1 and L2 were also asked about their genAI use in general and for specific tasks for academic purposes. The results of this quantitative part of the survey are published in Ketzer-Nöltge and Rüger (in press) and are summarized in the following. To enable a longitudinal comparison, the participants were divided into two cohorts, each of which comprised two consecutive semesters (Cohort 1: May 2023 to February 2024 and Cohort 2: April 2024 to February 2025). The data showed that students were increasingly using AI for their studies (approximately 90% of respondents in cohort 2 vs. 40% in cohort 1) and that AI was being used in more differentiated ways in the study context. A comparison of the two language groups (L1 vs. L2, encompassing both cohorts) revealed many

similarities but also a tendency for L2 German students to use genAI tools more frequently for writing, correcting, and rephrasing study-related texts. In contrast, students with L1 German used these tools more often for conceptual tasks, such as brainstorming and creating outlines. The current paper reports the results of the same survey on selected aspects of AI literacy, particularly students' knowledge of genAI and their attitudes and opinions about the potentials and limitations of using genAI in an academic context.

1.2. Definitions of artificial intelligence

It is imperative that students, as users of genAI-based tools, possess a fundamental understanding of the nature of AI. To that end, it is essential that they understand how a particular AI-supported tool works and what it is based on, thereby acquiring an understanding of its capabilities and applications. Consequently, the present survey inquired about the respondents' conceptions and definitions of AI. In the following, this paper will therefore elucidate the various definitions of AI that are discussed in the extant research literature. These definitions also correspond to the deductive codes used to categorize the students' answers, which are noted in parentheses.

There are numerous competing descriptions of the term AI, which are not necessarily mutually exclusive. The term Artificial Intelligence was coined in 1956 by John McCarthy (cf. Russel & Norvig, 2010, p. 27), who focused on the comparison with human behavior: The objective is to engineer machines that exhibit behaviors akin to human intelligence (see also Nilsson, 2009). Loder and Nicholas (2018, p. 11) formulate this as follows: "Computers that perform cognitive tasks, usually associated with human minds, particularly learning and problem-solving." (Code 1) (the concept of Codes is explained in section 3.1.1 below).

Current definitions of AI frequently allude to the acquisition of knowledge without guidance: "Artificial Intelligence (AI) is a broad term used to describe a collection of technologies that can solve problems and perform tasks to achieve defined objectives without explicit human guidance" (Cisek, 2021, p. 4) (Code 2). This definition encompasses a further aspect, namely that AI does not refer to a (single) specific technology, but is used as a generic term for various (analytical) methods, such as machine learning, data mining, neural networks, deep learning, or specific algorithms (Celik, Dindar, Muukkonen, & Järvelä, 2022) (Code 4).

According to Long and Magerko (2020, p. 3), many people perceive AI as synonymous with robotics (Code 5), leading to the attribution of the designation "not AI" to any entity that does not exhibit human-like intelligence (ibid.). This is where the distinction between weak/narrow AI (AI for explicitly delineated, specific tasks) and strong/general AI (vision for AI that emulates human intelligence across diverse domains) becomes salient (ibid.), whereby contemporary AI, particularly generative AI/large language models, can be exclusively ascribed to the former category.

In the academic domain, which is the focus of this study, students primarily engage with textual materials. Consequently, Natural Language Processing (NLP), defined as the automated processing of human language (e.g., ChatGPT), is predominantly utilized in this context. Respective tools are also classified as generative AI because they generate language (cf. Köbis, 2023, pp. 34–36). A corresponding understanding of currently available AI applications and the classification of new ones is part of AI literacy, which will be described in more detail below.

1.3. AI literacy

At this point, the competencies required to work successfully with AI in higher education will be discussed. We will focus on the AI literacy model developed by Long and Magerko (2020), which provides respective competencies for the analysis of the survey results reported.

Long and Magerko (2020) define AI literacy as "a set of competencies that enable individuals to critically evaluate AI technologies; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace" (Long & Magerko, 2020, p. 2). The objective is thus the adept and contemplative utilization of AI as a tool, for which media competencies in

general (digital literacies) are a fundamental prerequisite, as well as particular competencies pertaining to AI. In their article, Long and Magerko (2020) conducted a comprehensive review of 150 scientific publications on AI competencies (including gray literature) in the field of AI education for learners without a technical background (as a Scoping Study). The identified 17 competencies are then classified into five overarching areas (Long & Magerko, 2020): "What is AI?" (competencies 1-4), "What can AI do?" (competencies 5-6), "How does AI work?" (competencies 7-15), "How should AI be used?" (competency 16), and "How do people perceive AI?" (competency 17) (Long & Magerko, 2020, pp. 3-10).

The first area of competence, "What is AI?" (cf. also 1.2), is pertinent for students who utilize AI in their studies. This is particularly relevant when certain expectations regarding the performance of AI tools are not aligned with reality. For instance, expectations regarding the accuracy of content generated by (mere) LLM are misguided, as these have not been developed nor trained for this task. As stated by Long and Magerko (2020, p. 3), "the ability to recognize AI [...] is a critical skill necessary for informed interactions with AI." Hence, the survey's primary focus is on this first competence area of AI literacy, as a comprehensive understanding of AI is fundamental to its recognition and effective utilization. Consequently, participants were requested to provide their own definition of AI (see 3.1).

The second area of competence, "What can AI do?" is concerned with two aspects. Firstly, it encompasses an understanding of the strengths and weaknesses of AI, which falls under competency 5. Secondly, it involves the ability to envision the future of AI, which falls under competency 6. This area is also encompassed by the scope of our survey. The third area, entitled "How does AI work?" is only partially addressed in the current survey, yet it plays a role in our inquiries concerning students' own approaches to using AI tools. The fourth area, entitled "How should AI be used?" focuses primarily on ethical aspects (competency 16). The students' reflections on this topic are integrated into their expectations and concerns regarding advancements in the domain of AI. The fifth area of competence "How do people perceive AI?" is also pertinent to these reflections (see 3.2).

1.4. Research questions and epistemic interests

The review of current studies indicates a necessity for diversified data collection concerning students' utilization of, cognizance of, and disposition toward AI, with a particular emphasis on a differentiation between students for whom German is their L1 or L2. Respective findings will enable conclusions to be drawn about whether, how, and to what extent students with German as an L2 may benefit from the use of generative AI in their studies at universities in German-speaking countries, and how they can be supported in a meaningful and targeted manner. The findings of this study may also be applicable to L2 students worldwide.

Moreover, extant surveys do not permit direct conclusions to be drawn about developments over a longer period of time, as the data collected at different points in time are hardly comparable due to the diversity of target groups and questionnaire items. To this end, surveys were conducted at multiple points in time over the course of two years. These considerations give rise to the following research questions:

1.   How often and for what purposes do students use (which) AI-based tools?
2.   What do students know about AI?
3.   What are students' attitudes toward the use of AI in their academic studies, particularly for coping with requirements of language for academic purposes?

For each of the three research questions, the data was analyzed comparing students with L1 and L2 German, additionally the development over the survey period was examined. The results of the first research question have been published previously by Ketzer-Nöltge and Rüger (in press; for a short summary see 1.1). The following therefore refers to the second and third research questions, only.

2. Method
2.1. Participants

This survey constitutes a longitudinal study, specifically a trend study, in which different subsets of a participant population are surveyed at multiple points in time. A total of 143 online questionnaires were completed by 136 respondents over a period of two years[1]. To establish two comparable cohorts, the participants were segmented into two groups, with each group encompassing two consecutive semesters. The sample size for the first cohort, ranging from May 2023 to February 2024, was 73 participants, while the second cohort, spanning from April 2024 to February 2025, comprised 63 (or 70 individuals, respectively[1]). The survey was administered as part of three courses: Two courses were specifically designed to address German as a Second Language for L2 students, with one being offered within the university-wide BA programs and the other within the MA program German as a Foreign/Second Language (GFL/GSL). The third course was a subject-specific content seminar in the BA GFL/GSL program. The students who were in attendance at the seminar were given the opportunity to complete the questionnaire during the course of the seminar. Alternatively, the remaining students could complete the questionnaire online. Participation was voluntary and not reimbursed.

The majority of respondents indicated in the demographic section of the survey that they were studying GFL/GSL (n = 7[1]), while 36 participants were studying other subjects in the field of linguistic and cultural studies. The subjects studied by the remaining participants can be assigned to the subject groups of social sciences (n = 22) and natural sciences (n = 6; one response missing). The distribution across degree programs is as follows: The data set includes 98 individuals who are studying in a BA program, 26 in an MA program, 11 individuals who are undergoing teacher training[2], and one individual was engaged in doctoral studies.

With regard to first languages (L1), the responses show that 32 participants grew up speaking German (three of whom also speak another L1). Additionally, nine participants started German language acquisition prior to the age of 11. Consequently, the total number of individuals who indicated German as a second language (L2) is 95, while the total number of languages indicated as their L1 is 25, with multiple L1s being possible. The most prevalent L1s are Arabic (n=19), Russian (n=12), Chinese (n=7), Spanish (n=7), and Ukrainian (n=7).

The respondents evaluated their own digital literacy on a scale ranging from 1 (beginner) to 10 (expert), with an average rating of 6.80 (SD = 1.76). The distributions of all characteristics presented here are comparable between the two cohorts (2023/24 and 2024/25) and language groups (L1 or L2 German). Therefore, it can be posited that the criteria L1, field of study, and self-assessed digital literacy do not exert an undue influence on the comparison groups to be addressed subsequently.

2.2. Materials

The survey instrument was composed of six sections. First, respondents provided demographic data (a). Next, respondents indicated their media skills and the frequency of their media use during their academic studies (b). Third, respondents were requested to describe their initial encounters with artificial intelligence (c). Fourth, respondents were asked to define artificial intelligence (d). Fifth, respondents were prompted to identify their experiences with artificial intelligence use in academic writing and work (e). Finally, respondents indicated their attitudes regarding artificial intelligence, in particular their expectations and wishes for the future (f). In section d), participants were asked to formulate their definitions as free text. In sections e) and f), closed questions (single and multiple choice) were supplemented by open questions on approaches, surprises, and challenges in AI use to date, as well as on the potential and concerns regarding further developments.

3. Findings

This chapter will report on and classify selected results. The present paper will focus on research questions 2 and 3, i.e., the students' attempts to define AI (3.1) and the respondents' attitudes toward AI (3.2). In each instance, the data analysis procedure will be first delineated, followed by the presentation of the results.

3.1. Students' conceptualizations and definitions of AI

3.1.1. Data evaluation procedure. In order to assess the open-ended responses to the item, "AI – what is it actually? Please try to formulate your own brief definition of 'Artificial Intelligence'.", we were able to inductively derive four codes from the extant literature (see 1.2)[3]:

- Code 1: comparison to human behavior / human intelligence, or rational behavior;
- Code 2: acquisition of knowledge / learning without (human) guidance, solely through input;
- Code 4: AI as equal to specific analytical method(s): algorithm, neural network, deep learning, machine learning, neural networks, etc.;
- Code 5: AI as synonym for robotics / robots.

Furthermore, an iterative coding process was employed, resulting in the creation of three additional deductive Codes:

- Code 6: naming a specific application/AI-based tool, such as ChatGPT (thus equating AI with the named tool);
- Code 7: naming / listing general (a) or specific (b) functions / goals of genAI (AI-based tools);
- Code 8: AI is reduced to being a searchable database or an advanced search engine.

Two supplementary codes must also be noted: The Code "unclassifiable" is used for responses that could not be interpreted (in the sense of the established Codes; 9 instances). For example, consider the response of P97 (L2), which falls outside the purview of the prevailing classification system: *It is a tool that scientists are constantly developing* (#01[4]). "n/a" is used when a response is missing (6 instances).

All responses were analyzed by two coders according to the presented code system[5]. Subsequently, cases that were initially coded differently underwent a process of standardization, and the underlying rationales were thoroughly documented[6].

3.1.2. Results. Given the detailed and multifaceted nature of the comments made by the students surveyed, a total of 42 responses were assigned multiple codes: 38 responses were assigned two codes, while 4 responses were assigned three codes.

With 56 cases, Code 7 "naming / listing general (a) or specific (b) functions / goals of genAI (AI-based tools)" was assigned most frequently (two times both general and specific functions were named). The following response is an example of a general function description (7a):

#02 (P2, L2) *These are media that people can use to make their lives easier.*

Specific functions related to AI-based tools (7b) include:

#03 (P69, L1) *Tools that can produce or evaluate texts, images, and videos based on different data* (In addition, Code 8 was assigned to this example).
#04 (P79, L1) *A writing program with access to various platforms that can help you answer a wide range of questions, provide suggestions, or solve tasks.*

The second most common response was Code 1, i.e., definitions of AI that refer to comparisons with human behavior, intelligence, or rational thinking (34x):

> #05 (P44, L2)   *When machines try to imitate human abilities.*
> #06 (P113, L1) *the ability of the machine to perform tasks that normally require human intelligence (making decisions, being creative, etc.)*

In most cases, Code 1 appears alone, but is sometimes specified with concrete or general functional assignments (5x codes 1 + 7), e.g.:

> #07 (P142, L2) *Imitation of human cognitive abilities in order to obtain information or achieve performance faster (not necessarily more correctly).*

It is noteworthy that three individuals supplied definitions of such complexity and comprehensiveness that Codes 1 and 2 were jointly allocated to them, e.g.:

> #08 (P19, L1) *AI can independently establish connections between topics, draw conclusions from them, and learn from them. In this sense, it forms an analogy to the cognitive processes in the brain/human memory, in which new neural connections are constantly being created and new knowledge is stored and linked to existing knowledge.*

These three respondents are all BA students of GFL/GSL or German studies from the first cohort (P5, P17, P19). They rate their media skills as "average" (5, 6, 6) and indicate German as their L1.
     Subsequently, the categorization of AI as data collection or search engine (Code 8) manifests itself 33 times.

> #9 (P70, L1) *AI is a computer program (software) that searches for information on the Internet on demand or provides the information with which it was trained.*
> #10 (P102, L2) *AI collects results and data available on the internet and presents them in a structured manner.*

This Code occurs particularly frequently in connection to the naming of functions (Code 7; 13x):

> #11 (P33, L2) *A tool that can perform tasks by collecting large amounts of data.*
> #12 (P71, L1) *AI is a program that can serve different purposes. For example, it can be used as a search engine or to create images or texts. What makes it special is that it responds to search commands in a very individual and precise manner.*

Code 2, which refers to unguided learning by AI, was assigned a total of 20 times, only 6 of which were independent (e.g., #13: for *self-learning program*, P86, L2) and the rest in combination with Code 1 (3x), Code 7 (4x), Code 8 (3x), Code 4 (3x) and once together with Codes 1 and 7:

> #14 (P143, L2) *AI is a technological product that is capable of processing large amounts of information, performing various tasks, and, above all, learning like a human being.*

Specific analytical methods (Code 4) were mentioned 14 times (e.g., #15: *neural networks*, P65, L1), and 6 people understand AI as synonymous with robotics / robots (Code 5):

> #16 (P130, L2) *online machine-human / robot that generates information.*

A specific AI application (Code 6, here: #17: *ChatGPT*) was referenced on a single occasion by P83 (L1) as a definition or synonym for AI.

In the L1 group, the responses were distributed almost evenly across Codes 1, 2, 7, and 8, with each code accounting for approximately 20% of the total (see Table 1). A comparison of the two language groups reveals differences primarily regarding Code 7. It was assigned to slightly more than one third of the responses (36%) from respondents with L2 German, but only 20% of L1 speakers. The responses of the L2 participants were particularly infrequent for Code 2 (L2: 6% *vs.* L1: 22%).

Table 1.
Distribution of Codes (including multiple codings) among all given answers (in percent)

Codes	Percentage of Codes (overall; n = 144)	Percentage of Codes (L1; n = 55)	Percentage of Codes (L2; n = 124)
Code 1: Comparison to human behavior / human intelligence, or rational behaviour	19%	20%	19%
Code 2: Acquisition of knowledge / learning without (human) guidance, solely through input	11%	**22%**	**6%**
Code 4: AI as equal to specific analytical method(s): algorithm, neural network, deep learning, machine learning, neural networks, etc.	8%	7%	8%
Code 5: AI as synonym for robotics / robots	3%	2%	4%
Code 6: Naming a specific application / AI-based tool, such as ChatGPT (and thus equating AI with the named tool).	1%	2%	0%
Code 7: Naming / listing general (a) or specific (b) functions / goals of genAI (AI-based tools).	31%	**20%**	**36%**
Code 8: AI is reduced to being a searchable database or an advanced search engine.	18%	24%	16%
unclassifiable	5%	4%	6%
n.a.	3%	0%	5%

3.2. Student's attitudes toward AI-supported tools
3.2.1. Data evaluation procedure. The final section of the survey addressed the students' impressions, expectations, and attitudes regarding the integration of AI in their academic pursuits. First, closed questions were used to gather the students' conjectures regarding the (future) utilization of AI for various predefined study-related activities. Second, the students were presented

with the opportunity to elaborate on and provide clarifications for their assessments through free-text responses.

The items for the closed questions were formulated based on the research process (e.g., "selecting quotes and incorporating them into texts" or "developing research questions") and supplemented with additional study-related aspects (e.g., "AI as a learning coach", "evaluation of exam performance"). The provided answer options, which range from positive expectations to skepticism or concerns, were numerically coded as follows in order to identify corresponding trends and draw comparisons (German original in parentheses):

+2 = That is/will be a great relief. ("Das ist/wird eine große Erleichterung.")
+1 = Sounds cool, but is it possible? ("Klingt cool, aber geht das?")
0 = I have no idea. ("Keine Ahnung.")
-1 = This still requires people. ("Dafür braucht man weiter Menschen.")
-2 = That worries me. ("Das macht mir Sorgen.")

This also made it possible to calculate averages for individual subgroups, which revealed a tendency toward optimistic, to rather cautious or skeptical attitudes.

The closed questions in this final section of the questionnaire were supplemented by the following open-ended questions (free text): "Where do you see the greatest potential for AI in the next 2-3 years?" and "What do you consider unrealistic with regard to AI in the next 2-3 years? What are the concerns that you have regarding this matter?" The responses were coded deductively, with multiple items from the closed questions also being utilized as codes (see Appendix III). As the students' open comments were designed to provide additional context and clarification to their responses to the closed questions, they are primarily presented in relation to the quantitative results. This approach is taken to obtain a more precise representation of the students' positive expectations, as well as their concerns and doubts.

3.2.2. Results. In the following, first, a presentation of general findings from the open-ended comments will be made, after which a summary of important results from the closed question on students' expectations of AI in an academic context will be presented. Important results will be supplemented by quotes from the open-ended questions.

a) General results of the open-ended questions
It should be noted that approximately 20% of the 136 respondents did not respond to the two open-ended questions. The proportion of those non-responders is much higher among cohort 1 and among L2 students compared to the other groups. 26 students did not respond to the question regarding potentials of AI or they indicated that they lacked the necessary knowledge to provide a comprehensive assessment. A total of twenty-five students did not provide responses to the inquiry regarding their concerns about AI. The following and analogous statements are also coded as "No answer / don't know":

#18 (P100, L2) *I really don't know enough about it, I have no idea. I'm actually not very interested in the topic.*
#19 (P73, L2) *I still have to learn.*

The open comments, in particular, demonstrate that the majority of students occupy a position between two extremes. A mere 10% of the polled student population falls into either the "extremely optimistic" (code 2-8, n=12) or "very skeptical" (code 1-11, n=11) categories regarding the imminent prospects of AI, albeit without providing further elaboration. This phenomenon is exemplified by the following statements, among others:

#20 (P27, L2) *Everything is realistic, to be honest*
#21 (P103, L2) *Nothing is impossible.*
#22 (P143, L2) *There are no limits to the sky*
vs.
#23 (P85, L1) [Potentials] *I do't see any.*
#24 (P52, L2) *I'm not interested in AI, so I don't see any potential [...]*

Most of the students' comments relate to academic work and study tasks, e.g.:

#25 (P62, L1) *It will change academic tasks just as the calculator changed math class*

However, a significant number of comments express skepticism regarding the social impact of AI developments, e.g.:

#26 (P13, L2) *I am concerned that parts of the population will feel useless: potential for social unrest.*
#27 (P28, L2) *It will become more difficult to know what is real and what is artificial.*
#28 (P105, L2) *That artificial intelligence will be used in wars and to harm humanity*

In a subset of approximately 20% of the comments, all groups most frequently indicated a rather general simplification for various domains of work as a potential benefit (Code 1-1).

#29 (P59, L2) *Saving time on extensive tasks*
#30 (P83, L1) *Making certain tasks easier or easier to understand*

The most frequently articulated concerns or doubts relate to the uniqueness of human interactions compared to those with machines (Code 2-1). This perspective is shared by 28% of the respondents. However, the belief that AI is incapable of assuming all human tasks or that human intervention is necessary for AI to function is expressed at a much higher frequency in cohort 2 (38%) than in cohort 1 (19%). L1 and L2 students do not differ in this regard. This is evidenced, for example, by the following statements:

#31 (P23, L2) *You can never write a term paper with it*
#32 (P80, L2) *People still need people. And AI still makes mistakes.*
#33 (P110, L2) *Even as AI continues to evolve, human input will still be necessary.*

b) Evaluation of the role of AI in Academic Studies

As answer options to the closed question, "How would you rate the potential of AI-based tools for your future studies in the following areas?" ("Wie schätzen Sie das Potenzial von KI-basierten Tools für Ihr weiteres Studium in den folgenden Aufgabenbereichen ein?"), the following 15 areas were specified:
   a) Generating and structuring ideas ("Ideen generieren und strukturieren")
   b) Help with wording, text correction ("Formulierungshilfe, Textkorrektur")
   c) Writing texts/drafts ("Text(entwürf)e schreiben")
   d) Researching contents, managing sources ("Inhaltlich recherchieren, Quellen verwalten")
   e) Selecting quotations and incorporating them into texts ("Zitate auswählen und in Texte einbauen")
   f) Formatting text ("Texte formatieren")
   g) Developing research questions ("Forschungsfragen entwickeln")
   h) Preparing data, e.g., transcription ("Daten aufbereiten, z. B. Transkription")

i) Analyzing data, e.g., coding ("Daten analysieren, z. B. Kodierung")

j) Creatively expressing thoughts as images, sounds, or videos ("Gedanken als Bild, Ton, Video kreativ umsetzen")

k) Programming without programming skills ("Programmieren ohne Programmierkenntnisse")

l) Assessment ("Prüfungsleistungen bewerten")

m) AI as personal tutor ("KI als persönlicher Lerncoach")

n) Providing individual learning content / tasks ("Lerninhalte/-aufgaben individuell kombinieren")

o) Learning through exchange ("Lernen durch Austausch")

The students' expectations for the various areas of application differ quite considerably in some cases. In Figure 1, the two upper categories of each bar correspond to confident assessments. As can be seen, students' attitudes toward any area of application of AI are more positive when the bar is lighter. Students see considerable potential for AI in the domains of text correction and formatting, as well as in the preparation of research data. A large proportion of students also have high expectations for the use of artificial intelligence in literature-based research. Skepticism pertains to the utilization of AI for assessment and its potential role as an individual learning coach. No definitive optimistic or skeptical stance can be ascertained for the other areas of application.
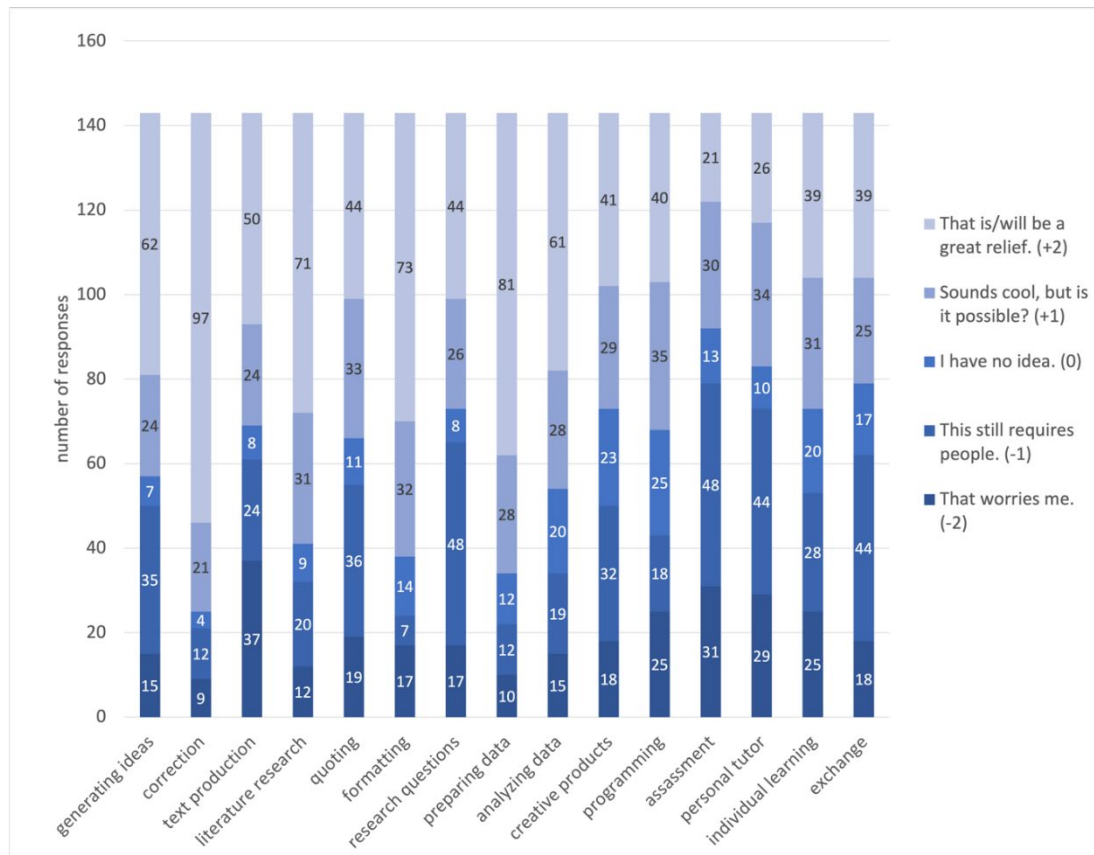

Figure 1. Expectations regarding the use of AI for various activities. Distribution of overall responses to preformulated items in absolute numbers, sorted from negative "That worries me." (-2, dark blue) to positive "That is/will be a great relief." (+2, light blue).

Consequently, in the open-ended question concerning the prospects of AI—in addition to an anticipated general simplification of work, especially for routine tasks (Code 1-2, 15x) —frequently positive expectations are expressed for tasks involving working with texts (Code 1-6, 11x), idea

generation (Code 1-3, 13x), and the processing of research data (Code 1-5, 11x). For instance, the following statements were made:

> #34 (P15, L2) *Perhaps AI can help with proofreading, finding sources, or structuring ideas.*
> #35 (P16, L1) *Many people find it difficult to start homework assignments and instead put them off. If AI can help by gathering and structuring ideas, many people will be more motivated.*
> #36 (P137, L2) *[...] simplification when dealing with complicated programs such as data analysis [...]*

The concerns highlighted in the quantitative data are corroborated by the open comments. The respondents generally ascribed particular importance to a diversified human perspective (Code 2-1, 38x). In addition to emphasizing personality, individuality, and emotions as unique characteristics of humans (Code 2-1d, 13x), the use of AI for evaluating exams (Code 2-1a, 16x) and as a learning companion (Code 2-1b, 10x) is viewed with particular skepticism:

> #37 (P71, L1)   *AI cannot recognize human feelings and thoughts. This means that it can only evaluate exam performance if this is completely irrelevant to the task at hand. Individual writing style also plays a role here. Can AI recognize what is well written and what is poorly written?*
> #38 (P132, L2) *AI as a personal learning coach lacks empathy, which is important.*

c) Comparison of language groups

For most areas of application, the mean responses of L1 and L2 students are relatively close, however some differences also become apparent. The graph in Figure 2 shows the means for all students (left bar, blue), for L1 students only (middle bar, red), and for L2 students only (right bar, green) for each task area. Overall, most assessments are slightly positive (mean for all task areas: +0.46). Since the scale ranges from minus 2 to plus 2, mean values close to 0 indicate a divided picture of opinions. For L1 students in particular, the mean is relatively high in some cases (above 1). L1 students are clearly more optimistic than L2 students, especially in the task areas related to the research process. The discrepancy between L1 and L2 students is particularly strong in their assessment of the potential of AI for research, text formatting, formulating research questions, handling research data, and for individualizing learning processes. When it comes to creative tasks and designing their own learning (AI as a tutor and exchange partner), but also with regard to the assessment of exams (with -0.27 overall, the lowest value), L2 students show slightly more confidence in AI than L1 students. In general, however, students are much more skeptical about the latter tasks than about most research-related activities. The greatest agreement between L1 and L2 students can be seen on the potential of AI for text correction, with the highest overall value (+1.29), and on skepticism regarding the use of AI for selecting and using citations in writing for academic purposes.
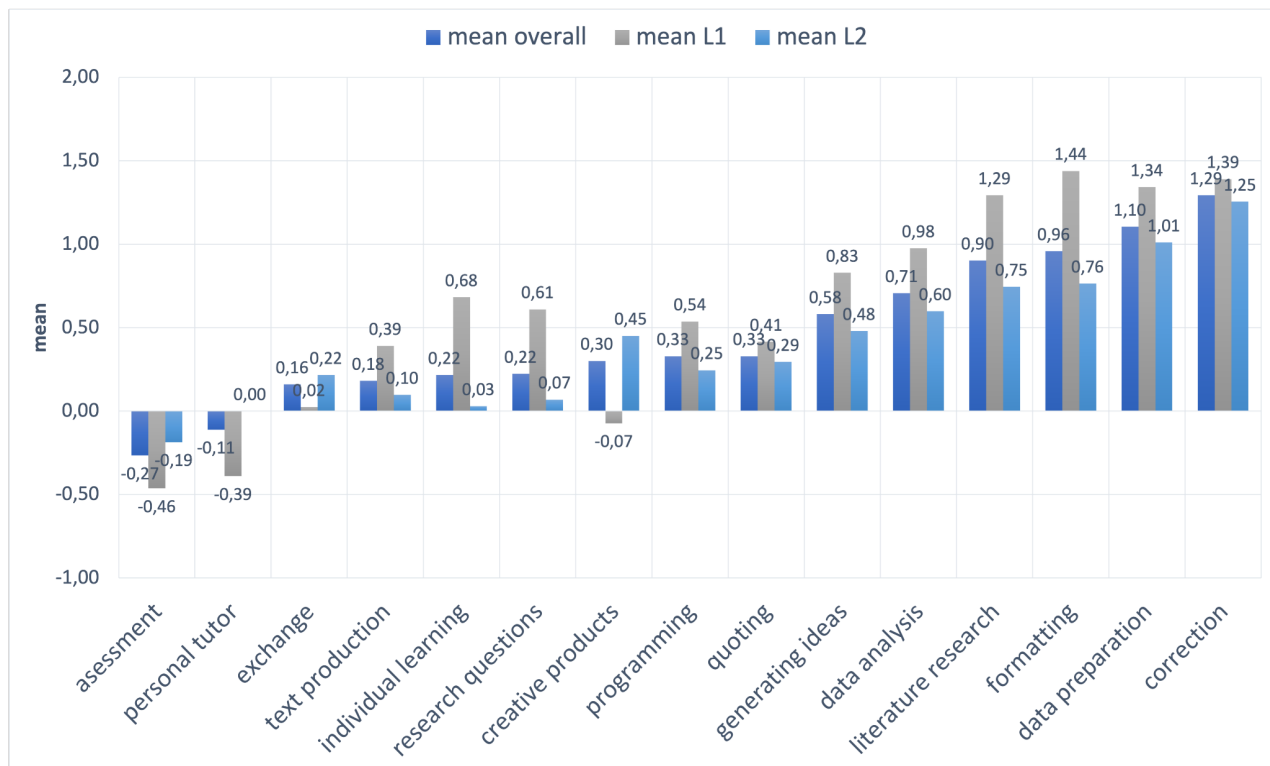
Figure 2. Expectations regarding the use of AI for various activities. Comparison of results between language groups (L1 vs. L2), sorted by increasing mean value (overall).

It is evident from the free comments that only minor discrepancies between language groups are discernible. Most notably, students with L1 German express higher levels of confidence in the use of AI-powered research assistance. This finding is consistent with the quantitative data analysis. Concerning the reliability and credibility of research outcomes in the field of AI, both L1 and L2 students concur on the associated concerns (Code 2-4, 16x, with 7x being L1 and 9x being L2):

> #39 (P17, L1) *AI frequently makes mistakes or works with "made-up facts" and is therefore not particularly reliable.*
> #40 (P137, L2) *Researching sources -> currently difficult because, for example, ChatGPT cites non-existent sources and quotes incorrect passages/no passages at all.*

Conversely, a greater proportion of spontaneous comments from L2 students (code 1-5, 11x, of which 1x L1 and 10x L2) pertain to the potential of AI in data analysis, thereby contextualizing the quantitative findings. A discernible discrepancy emerges in the quantitative data concerning the individualization of learning processes, with L1 students exhibiting a more pronounced inclination than L2 students. Within the section designated for free comments, general explanations are provided that refer to the education system or educational institutions outside the university (Code 1-7, 11x). It is also important to note that some of these explanations include the broader accessibility of learning resources.

> #41 (P50, L2) *Transcriptions and accessibility in education.*
> #42 (P70, L1) *As an individual learning coach (too many students, too few teachers; every student can be supported more individually with AI).*

However, an excess of individual support from AI gives rise to concerns that independence will be curtailed due to excessive reliance on AI. Code 2-3, designated "People become lazy, dumber, and

less independent through the use of AI", was assigned 20 times, with corresponding statements distributed proportionally across cohorts and language groups.

#43 (P100, L2) *My concern is that the thought process is increasingly being left to third parties—until one is no longer able to formulate a thought themselves.*

d) Comparison of cohorts

A comparison of the two survey periods also yields some interesting results. As illustrated in Figure 3, the alterations are evident in a number of selected task areas. For the majority of task areas, no significant alterations or only negligible increases in the mean values are evident when comparing cohort 1 (2023/24) with cohort 2 (2024/25). The overall mean value increased from 0.43 to 0.5. The most prominent increases are observed within the range of 0.1 to 0.2 (for instance, in the context of data analysis, from 0.63 to 0.79, or for the utilization of artificial intelligence for the selection of quotations, from 0.25 to 0.41). A more substantial increase in confidence in AI is evident in the domains of text correction (from 1.12 to 1.47) and text production (from 0.01 to 0.36). By contrast, there has been a substantial decline in students' optimism regarding the utilization of AI for research tasks, with a decrease from 1.15 to 0.64.
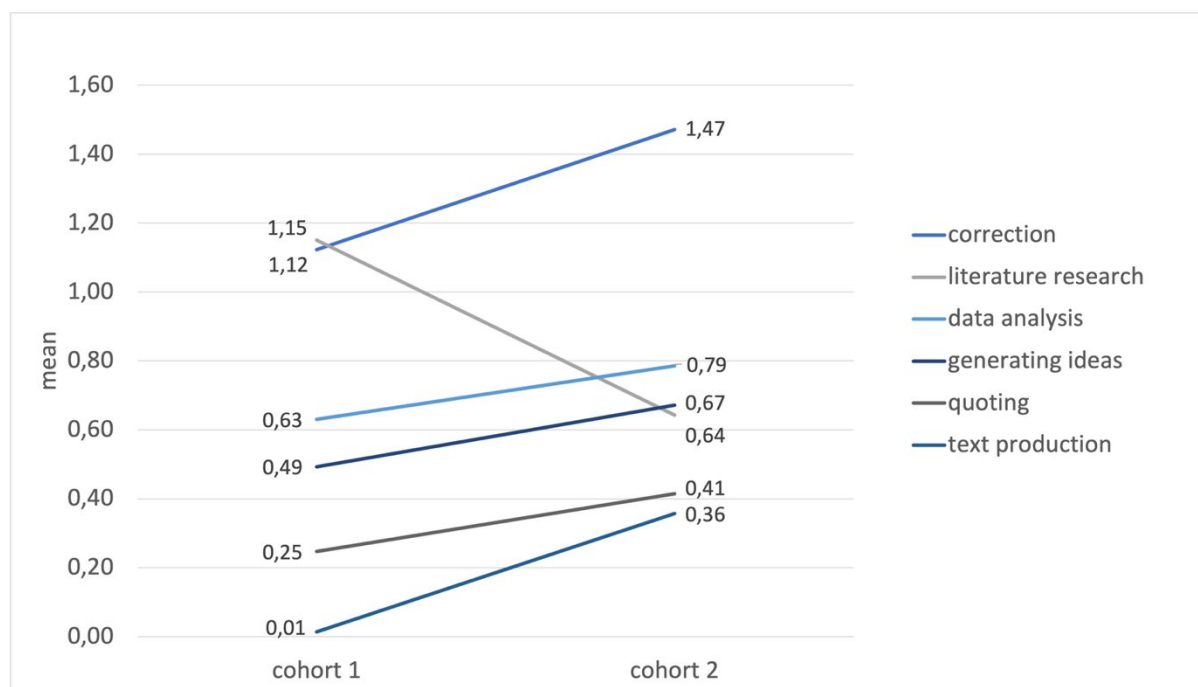

Figure 3. Changes in expectations regarding the use of AI for various academic activities. Comparison between means of the two cohorts for selected task areas.

The lower level of optimism among cohort 2 regarding AI as an aid to research activities is also evident in the students' free comments (Code 1-4, cohort 1: 9 out of 73 vs. cohort 2: 4 out of 63). Concurrently, cohort 1 also refers more frequently to concerns about fake news, bias, and unreliable research results (code 2-4, cohort 1: 12x vs. cohort 2: 4x). In some cases, the same individuals express both optimism and concerns on this topic, e.g.:

#44 (P82, L1) Question about the potentials of AI: *In my opinion, AI can enable quick research and ensure that you can quickly get a basic idea of tasks. Very good for presentations/term papers*

#45 (P82, L1) Question about concerns towards AI: *Incorrect information*

A final illustrative example demonstrates this contradiction through the juxtaposition of optimistic expectations and doubts within the same statement. In this statement, an additional aspect becomes apparent, namely the recognition that certain skills are required in order to utilize the new technological possibilities in a meaningful and targeted manner (Code 1-12).

#46 (P35, L2)   *AI can shorten the path to new ideas and promote human creativity, but only if it is used correctly (as a tool, not an author) and if we learn to ask precise questions.*

4. Discussion
The most important findings will now be summarized and discussed. Overall, the presented data suggests that, as expected, knowledge of AI (see section 3.1) and attitudes toward its potential and challenges in academic contexts (see section 3.2) are heterogeneous. However, given the wide range of LLM-based AI tools and their concrete applications for study-related tasks, some of which have already been tested with positive results, it is surprising how little students know about and use these tools (on the usage see Ketzer-Nöltge & Rüger, in press). The most common attempts at definition (Code 7 – naming functions of AI tools and Code 8 – database/search engine) reflect that many students' ideas of what AI is, remains vague. On the other hand, AI seems so ubiquitous as a basis for applications, and the tools that work with it are so diverse, that this does not automatically lead to a concrete idea of what AI may be. Clearly, students associate AI, a rather complex concept, with something they are familiar with, an understandable strategy for comprehension. At the same time, the idea that AI makes large amounts of data analyzable and usable is accurate and fundamental to critically assessing what happens to one's own data. Concerning this, five students explicitly expressed corresponding concerns about data protection elsewhere (3.2).

Code 7, i.e., the naming of specific AI functions, was by far the most frequently assigned code for L2 students' definition attempts (36%), while three of the most conceptually comprehensive definitions (Codes 1 and 2) came from native German speakers. Due to the restricted number of participants, differences between language groups should not be overinterpreted; however, these differences in definitions between L1 and L2 speakers could mean that it is linguistically easier to name concrete functions and applications (Code 7) than to provide abstract, conceptually comprehensive definitions (e.g., expressing uncontrolled learning as a property of AI, Code 2).

Overall, many respondents demonstrated only limited understanding of what AI is, how it works, and how generated data is created. Only a few of the students surveyed were able to provide a definition of AI that indicated that they knew and understood the basic functioning of genAI. However, keep in mind that complex answers (codes 1 and 2; #08) do not necessarily mean that students are knowledgeable about these aspects; they may simply be repeating what they have heard or read. Nonetheless, detailed answers show that students are engaged with the topic and find it relevant.

The results allow us to draw cautious conclusions about the group surveyed regarding the areas of AI competence described by Long and Magerko (2020), such as "What is AI?", "How does AI work?" and "What can AI do?". These competence areas seem to be underdeveloped in many students. The results suggest that university teaching should give greater consideration to the topic of AI, its fundamentals, and how it works. This is necessary to ensure students can use AI-based tools purposeful and effectively.

The answers to the definition question and the other open questions reflect social debates within and beyond the academic context. These debates include the expectation of a general relief of workload in many areas along with the risk of massive job losses. It also includes the influence of AI on creative human activities and ethical concerns such as questions of data protection and the appropriate use of genAI.

However, a relatively large proportion of respondents (more L2 than L1 students) did not take the opportunity to answer the open questions about the potential and challenges of genAI. In some

cases, they explicitly stated that they did not yet have sufficient knowledge to answer. In cohort 2, however, the proportion of unanswered questions decreased by far. This can certainly be attributed to the increasing public presence of the topic, but above all to the students' own experiences, meaning that they are more familiar with genAI and have formed opinions on the topic.

The questioned students see a lot of potential, but they also express concerns, some of which concern society and are global in nature, others relate to their professional future. These concerns reflect the public debate about the disruptive potential of AI technology. Many responses address the question of the human component: What specific human abilities and skills cannot be replaced by AI? In this regard, a differentiated view, individual personality, and emotions are mentioned as particularly relevant for tasks such as exam assessment and learning support—areas of AI application viewed with skepticism (see Figure 2).

According to the data presented here, students with German as their L2 tend to be slightly more optimistic than L1 students about AI's potential for performing routine tasks. However, they also express greater concern about AI replacing humans in many professional fields. Quantitative data on students' expectations for using AI for various study-related tasks shows that students with German as their L1 are more optimistic overall, even if the differences are small. Expectations were positive for almost all of the suggested task areas on a scale from +2 to –2. Respondents saw the greatest potential (with a mean value of over +1) in text correction and in preparing research data. They were particularly skeptical about using AI for exam assessment and as a learning coach. Students are also divided on the generation of text by AI (AI-supported text production: mean value close to 0). Consequently, it can be inferred that conceptual activities performed by humans and interaction with humans in academic context remain important to students.

A comparison of the two cohorts (2023/24 *vs.* 2024/25) revealed that concerns about the unreliability of AI-based tools declined. The greatest increase in expected potential is seen in the use of AI for text correction. Although AI-supported tools are indeed becoming more reliable, there is still a risk that AI is blindly trusted, based to an overestimation of the usefulness and functionality of AI-based tools and an uncritical approach to AI-generated outputs. Critical and reflective promotion of AI skills at universities is necessary in this context as well, including the ethical component targeted with Competency 16, "How should AI be used?" by Long and Magerko (2020).

Conversely, fewer students in the 2024/25 cohort see positive potential for source work and scientific research with AI tools. Regarding this, trust is much higher among L1 students than among L2 students. The lack of trust in AI-based tools for literature research may be due to (L2) students' frequent use of these tools with poor results. This may be because AI is not used competently in this area, hence often delivering inaccurate, inappropriate, or incorrect results.

Finally, it should be argued that this study is a small-scale survey focusing exclusively on students at one university. This naturally limits the scope and generalizability of the results. However, in contrast to earlier studies, the present survey offers a more in-depth, qualitative analysis of knowledge, attitudes, and utilization of AI in higher education. The perspectives of different student groups—in this case, students with German as their L1 or L2—were also considered more thoroughly. However, when we regard the distinction between L1 and L2 as a continuum for comparing L1 and L2 students, it is not always possible to clearly classify the results. L2 students who have acquired German since childhood (and were categorized as L1 students in this study) may not have been socialized in the German education and academic system. However, this could be a decisive factor for the survey results presented here. Assigning these students to the L1 group (a total of nine students) may have led to an overemphasis or blurring of the results when comparing L1 and L2 students. Future studies with larger cohorts could examine this more closely.

5. Conclusion

The study presented here encompasses various courses offered at the Herder Institute of the University of Leipzig, including study programs for teacher training[2] as well as BA and MA

degrees. Since the survey was repeated in the same seminars (with different cohorts), it provides comparable insights into the status quo of knowledge and attitudes toward AI over two years, particularly regarding L2 students. L2 students made up approximately two-thirds of the respondents and have largely been overlooked in previous AI surveys at German universities. Due to its design as a longitudinal study, initial conclusions can be drawn about trends in attitudes toward AI since the widespread release of ChatGPT. However, it is unclear to what extent these results can be generalized to other university contexts.

The survey results show that the use of AI in higher education is developing dynamically. Students are also shown to be aware of social and academic debates on the topic of AI, and they are gaining experience that influences their knowledge and understanding of AI, as well as their assessments and expectations of future developments. Nevertheless, the results reveal respondents' uncertainties about the competent use of AI and their limited understanding of AI. Some respondents also have vague or contradictory expectations about AI's potential for academic work.

Comparing the AI usage of students with German as their L1 to those with German as their L2 would allow us to draw conclusions about whether L2 students benefit from AI in compensating for linguistic disadvantages in their studies. The current results show that—similar to L1 students—L2 students are familiar with some essential AI functions and characteristics and are increasingly concerned about the topic. Students (both L1 and L2) are more confident in the future potential of AI for text correction than for text production. Although L2 students use AI tools in many areas, they are more cautious than L1 students about the future of AI in most areas of study. Overall, respondents are particularly cautious about evaluating exams with AI and using AI as a learning companion, i.e., for activities more related to teaching. This also shows a fairly fundamental skepticism about AI performing tasks considered very human. Nonetheless, confidence is increasing for certain tasks in the academic work process.

However, the available data does not allow us to conclude that L2 learners benefit from AI in their studies. This would require a different study design that focuses on specific AI usage processes and results. Such a study would be worthwhile, especially since language skills are important for interacting with AI. Language is the most important medium for education and the central interface of human-computer interaction (e.g., Ballod, 2024, p.82). Accordingly, there is currently a discussion about prompting skills (see, e. g., Gattupalli, Maloy, & Edwards, 2023), and there is a growing trend of user-friendly AI tools offering prompt support. As discussed above (see 1.2), meaningful prompting is just one of many AI skills that need to be developed. The present study's heterogeneous results indicate that these skills do not arise automatically but require targeted promotion in courses to provide all students with equal opportunities. Budde, Tobor, and Friedrich (2024, p. 25), among others, argue that AI skills must be firmly anchored in all programs of study and they hold university management, rather than individual teachers, responsible for this.

Notes

[1] Seven respondents stated that they were participating in the survey for the second time.

[2] As many German universities, University of Leipzig offers degree programs targeted specifically at teacher students as an alternative to MA and BA programs, ending with a state examination.

[3] Code 3 was originally designated for statements that exhibited characteristics of Codes 1 and 2. This approach was subsequently discontinued in favor of a more systematic "double coding".

[4] To ensure transparency, all data examples provided within the paper are numbered consecutively and translated into English. In addition, Appendix I contains a tabular overview listing the original, uncorrected responses in German.

[5] The percentage of rater agreement is 79.02%. Cohen's κ yielded $\kappa = 0.72$ as the proportion of agreement exceeding chance ($z = 18.9$, $p < .001$ ***). This can be classified as "good" (Altman 1991).

[6] All coding tables can be viewed on OSF and in Appendixes:
https://osf.io/smwfj/files/osfstorage/68567cf1b99951ad985cfd22 [2025-06-23].

Abbreviations
genAI – generative Artificial Intelligence
LLM – Large Language Model
L1 – first language
L2 – second language
GFL/GSL – German as a Foreign / Second Language
BA – Bachelor
MA – Master

Declaration of the conflict of interest
The authors have no conflicts of interest to declare that are relevant to the content of this article.

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Appendix I

Tabular overview of data examples provided within the paper, including the original, uncorrected responses in German and Englisch translations. Numbered consecutively according to order of appearance in the paper.

Example #	Participant	German Original	Englisch Translation
#01	P97, L2	*Es ist ein Werkzeug, das Wissenschaftler ständig weiterentwickeln*	*It is a tool that scientists are constantly developing*
#02	P2, L2	*Es sind Medien der Man nuzten kan um das Leben einfacher zu machen.*	*These are media that people can use to make their lives easier.*
#03	P69, L1	*Tools, die basierend auf unterschiedlichen Daten, Texte, Bilder und Videos produzieren bzw. auswerten können*	*Tools that can produce or evaluate texts, images, and videos based on different data*
#04	P79, L1	*Ein Schreibprogramm mit Zugang zu verschiedenen Plattformen, die einem helfen können verschiedenste Fragen zu beantworten oder Anregungen zu geben oder auch Aufgaben zu lösen*	*A writing program with access to various platforms that can help you answer a wide range of questions, provide suggestions, or solve tasks*
#05	P44, L2	*Wenn die Maschinen menschliche Fähigkeiten imitieren versuchen.*	*When machines try to imitate human abilities.*
#06	P113, L1	*die Fähigkeit der Machine, die Aufgaben zu erledigen, die normalerweise menschliche Intelligenz erfordern (Entscheidung treffen, kreativ sein usw)*	*the ability of the machine to perform tasks that normally require human intelligence (making decisions, being creative, etc.)*
#07	P142, L2	*Imitation menschlicher kognitiven Fähigkeiten, um Informationen zu erreichen oder Leistungen schneller (nicht unbedingt richtiger) zu erzielen.*	*Imitation of human cognitive abilities in order to obtain information or achieve performance faster (not necessarily more correctly).*
#08	P19, L1	*KI kann wie selbstständig Verbindungen zwischen Themen herstellen und daraus Schlussfolgerungen zu ziehen und*	*AI can independently establish connections between topics, draw conclusions from them, and learn from them. In this*

		dazu lernen. In diesem Sinne bildet sie eine Analogie zu den kognitiven Prozessen im Gehirn/dem menschlichen Gedächtnis, bei denen stetig neue neuronale Verbindungen entstehen und neues Wissen gespeichert und mit bereitsvorhandenem Wissen verknüpft wird.	*sense, it forms an analogy to the cognitive processes in the brain/to human memory, in which new neural connections are constantly being created and new knowledge is stored and linked to existing knowledge.*
#09	P70, L1	*KI ist ein Computerprogramm (Software), welche auf Nachfrage Informationen aus dem Internet heraussucht bzw. die Informationen zur Verfügung stellt, mit denen Sie trainiert wurde.*	*AI is a computer program (software) that searches for information on the Internet on demand or provides the information with which it was trained.*
#10	P102, L2	*KI sammelt Ergebnisse und Daten, die auf dem Internet zur Verfügung stehen, und gibt diese strukturiert wieder.*	*AI collects results and data available on the internet and presents them in a structured manner.*
#11	P33, L2	*Ein Tool die Aufgaben erledigen können, indem es große Menge von Daten sammelt.*	*A tool that can perform tasks by collecting large amounts of data.*
#12	P71, L1	*Eine KI ist ein Programm, das für unterschiedliche Zwecke dienen kann. Man kann sie bspw. als Suchmaschine nutzen, sich Bilder oder Texte erstellen lassen. Das Besondere ist, dass sie dabei sehr individuell und präzise auf den Suchbefehl eingeht.*	*AI is a program that can serve different purposes. For example, it can be used as a search engine or to create images or texts. What makes it special is that it responds to search commands in a very individual and precise manner.*
#13	P86, L2	*Selbstlernendes Programm*	*self-learning program*
#14	P143, L2	*KI ist ein technologisches Produkt, das in der Lage ist, eine große Menge an Informationen zu verarbeiten, verschiedene Aufgaben auszuführen und vor allem die Fähigkeit zu haben, wie ein Mensch zu lernen.*	*AI is a technological product that is capable of processing large amounts of information, performing various tasks, and, above all, learning like a human being.*
#15	P65, L1	*neuronale Netzwerke*	*neural networks*
#16	P130, L2	*online Maschinenmensch / Roboter, der Informationen generiert.*	*online machine-human / robot that generates information.*
#17	P83, L1	*ChatGPT*	*ChatGPT*
#18	P100, L2	*Ich kenne mich wirklich viel zu wenig aus, ich habe keine Ahnung. Mich interessiert das Thema tatsächlich eher wenig.*	*I really don't know enough about it, I have no idea. I'm actually not very interested in the topic.*
#19	P73, L2	*Ich muss noch lernen.*	*I still have to learn.*
#20	P27, L2	*alles ist realistisch ehrlich gesagt*	*Everything is realistic, to be honest*
#21	P103, L2	*Nichts ist unmöglich.*	*Nothing is impossible.*

#22	P143, L2	*Nach oben sind keine Grenzen gesetzt*	*There are no limits to the sky*
#23	P85, L1	[Potenziale] *Sehe ich nicht*	[Potential] *I don't see any*
#24	P52, L2	*Ich habe keine Interesse mit KI und dann sehe kein Potenzial [...]*	*I'm not interested in AI, so I don't see any potential [...]*
#25	P62, L1	*Es wird das wissenschaftliche Arbeiten verändern so wie der Taschenrechner den Matheunterricht veränderte*	*It will change academic tasks just as the calculator changed math class*
#26	P13, L2	*Ich mache mir Sorgen , dass Teile der Bevölkerung sich unnützlich fühlen: Potenzial für soziale Unruhe.*	*I am concerned that parts of the population will feel useless: potential for social unrest.*
#27	P28, L2	*Es wird schwieriger zu wissen was wahr oder künstlich ist.*	*It will become more difficult to know what is real and what is artificial.*
#28	P105, L2	*Dass künstliche Intelligenz in Kriegen und zum Schaden der Menschheit eingesetzt wird*	*That Artificial Intelligence will be used in wars and to harm humanity*
#29	P59, L2	*Zeitsparen bei umfangreichen Aufgaben*	*Saving time on extensive tasks*
#30	P83, L1	*Gewisse Aufgaben zu erleichtern oder Dinge verständlicher zu machen*	*Making certain tasks easier or easier to understand*
#31	P23, L2	*Man kann niemals damit eine Hausarbeit schreiben*	*You can never write a term paper with it*
#32	P80, L2	*Menschen brauchen immer noch Menschen. Und KI macht immer noch Fehler.*	*People still need people. And AI still makes mistakes.*
#33	P110, L2	*Auch wenn sich die KI weiterentwickelt, ist menschlicher Input weiterhin erforderlich.*	*Even as AI continues to evolve, human input will still be necessary.*
#34	P15, L2	*Vielleicht kann KI mit Korrekturlesen helfen oder Quellen zu finden oder Ideen strukturieren.*	*Perhaps AI can help with proofreading, finding sources, or structuring ideas.*
#35	P16, L1	*Es fällt vielen schwer, Hausarbeiten anzufangen und stattdessen schieben sie die vor sich her. Wenn durch eine KI geholfen und Ideen gesammelt und strukturiert werden können, bekommen viele mehr Motivation.*	*Many people find it difficult to start homework assignments and instead put them off. If AI can help by gathering and structuring ideas, many people will be more motivated.*
#36	P137, L2	*[...] Erleichterung beim Umgang mit komplizierten Programmen wie bei der Datenanalyse [...]*	*[...] simplification when dealing with complicated programs such as data analysis [...]*
#37	P71, L1	*Die KI kann keine menschlichen Gefühle und Gedanken erkennen. Somit kann sie Prüfungsleistungen auch nur dann bewerten, wenn so etwas völlig irrelevant für die Aufgabenstellung ist. Hier zählt auch der individuelle Schreibstil rein.*	*AI cannot recognize human feelings and thoughts. This means that it can only evaluate exam performance if this is completely irrelevant to the task at hand. Individual writing style also plays a role here. Can AI*

		Kann eine KI erkennen, was gut und was schlecht formuliert ist?	*recognize what is well written and what is poorly written?*
#38	P132, L2	*KI als persönlicher Lerncoach hat keine Empathie, was wichtig ist*	*AI as a personal learning coach lacks empathy, which is important*
#39	P17, L1	*KI macht häufi Fehler oder arbeitet mit 'ausgedachten Fakten' und ist dadurch nicht sonderlich verlässlich.*	*AI frequently makes mistakes or works with "made-up facts" and is therefore not particularly reliable.*
#40	P137, L2	*Quellen recherchieren -> momentan schwierig, weil z.B. ChatGPT nicht existierende Quellen und beim Zitieren falsche Textstellen/keine Textstellen angibt*	*Researching sources -> currently difficult because, for example, ChatGPT cites non-existent sources and quotes incorrect passages/no passages at all.*
#41	P50, L2	*Transkriptionen und Barrierefreiheit in der Bildung*	*Transcriptions and accessibility in education*
#42	P70, L1	*Als Individuellen Lerncoach (zu viele Schüler zu wenig Lehrer, jeder Schüler kann mit kI individueller gefördert werden*	*As an individual learning coach (too many students, too few teachers; every student can be supported more individually with AI*
#43	P100, L2	*Meine Sorgen bestehen darin, dass der Denkprozess immer öfter an Dritten überlassen wird – bis man selbst nicht mehr in der Lage ist, einen Gedanken zu formulieren.*	*My concern is that the thought process is increasingly being left to third parties—until one is no longer able to formulate a thought themselves.*
#44	P82, L1	Frage zu Potenzialen: *KI kann meiner Meinung nach schnelles Recherchieren ermöglichen und dafür sorgen, dass man schnell eine grundsätzliche Idee von Aufgaben haben kann. Sehr gut für Vorträge/Hausarbeiten*	Question about the potentials of AI: *In my opinion, AI can enable quick research and ensure that you can quickly get a basic idea of tasks. Very good for presentations/term papers*
#45	P82, L1	Frage zu Sorgen: *Falsche Informationen*	Question about concerns towards AI: *Incorrect information*
#46	P35, L2	*Die KI kann Wege zu neuen Ideen verkürzen und die menschliche Kreativität fördern, aber nur wenn man sie richtig nutzt (als Hilfsmittel und nicht als Autor) und wenn man lernt, genaue Fragen zu stellen.*	*AI can shorten the path to new ideas and promote human creativity, but only if it is used correctly (as a tool, not an author) and if we learn to ask precise questions.*

Appendix II

Codes used for responses to question asking for AI defitions

Code# in Paper "Meta-Cognition on AI" (CCD, 2025)	Original German code used in coding process	Code definition	Anchor examples (uncorrected German original)
Code 1 (inductive): Comparison to human behavior / human intelligence, or rational behaviour	1 – Vergleich zu menschlichem Verhalten / menschlicher Intelligenz, bzw. rationalem Handeln	"computers [that] perform cognitive tasks, usually associated with human minds, particularly learning and problem-solving" (Russel & Norvig, 2010, p. based on the original definition by McCarthy, 1956) and "that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment" (Nilsson, 2009, p. xiii).	"Künstliche Intelligenz versucht Antworten und Reaktionen ähnliche die eines Menschen zu geben."; "Tools/Programme/Frameworks, die die Aufgaben erledigen können, die gewöhnlicher Weise menschlicher Intelligenz bedürfen (zB Entscheidungen treffen, Übersetzen usw)"
Code 2 (inductive): Acquisition of knowledge / learning without (human) guidance, solely through input	2 – Aneignung von Wissen / Lernen ohne (menschliche) Anleitung allein durch Input	Reference to more recent attempts at definition: "Artificial Intelligence (AI) is a broad term used to describe a collection of technologies that can solve problems and perform tasks to achieve defined objectives without explicit human guidance" (Cisek, 2021, p. 4)	"KI bezeichnet eine Maschine oder ein Programm, die/das lernfähig ist."; "Ein Programm, welches mit meinen Input (und je nach vorhandenen Input/Informationen) neue Informationen bzw. Antworten generiert"; "Selbstlernendes Programm"
no separate code used for combinatons of several codes, codes are always named directly	3 – Mischung: Menschliche Intelligenz + Wissensaneignung durch Input	see 1 + 2	"Ein Algorithmus, der durch Unmengen an eingespeisten Daten von Nutzern deren Verhalten kopieren und damit "eigenes" Verhalten generieren kann"; "KI kann wie selbstständig Verbindungen zwischen Themen herstellen und daraus Schlussfolgerungen zu ziehen und dazu lernen. In diesem Sinne bildet sie eine Analogie zu den kognitiven Prozessen im

			Gehirn/dem menschlichen Gedächtnis, bei denen stetig neue neuronale Verbindungen entstehen und neues Wissen gespeichert und mit bereitsvorhandenem Wissen verknüpft wird
Code 7 (inductive): Naming / listing general (a) or specific (b) functions / goals of genAI (AI-based tools).	4 – Benennung / Auflistung von allgemeinen (a) oder konkreten (b) Funktionen / Zielen von KI (- Tools)	The functions or intended uses of AI tools are identified: general functions, such as being helpful (4a), or specific functions (4b), such as translation (translation program) / grammar correction / idea generation (a + b not always easy to differentiate).	"Hilfsmittel für unser Leben, kann z.B. das Erlernen anderer Sprachen, oder das Lehren erleichtern"; "Ein Schreibprogramm mit Zugang zu verschiedenen Plattformen, die einem helfen können verschiedenste Fragen zu beantworten oder Anregungen zu geben oder auch Aufgaben zu lösen"
Code 8 (inductive): AI is reduced to being a searchable database or an advanced search engine.	5 – Datensammlung / Suchmaschine	AI is reduced to being a searchable database or a better search engine.	"Künstliche Intelligenz ist eine Programm, dass Informationen aus einer Datenbank verarbeitet und so Fragen beantworten kann (mit der größten Wahrscheinlichkeit aus der Datenbank)."; "Ein Tool die Aufgaben erledigen können , indem es große Menge von Daten sammelt."
Code 6 (inductive): Naming a specific application / AI-based tool, such as ChatGPT (and thus equating AI with the named tool).	6 – konkrete Anwendung: z. B. ChatGPT	Name a specific application / AI tool, such as ChatGPT.	"ChatGPT"
Code 4 (inductive): AI as equal to specific analytical method(s): algorithm, neural network, deep learning, machine learning, neural networks, etc.	7 – Konkrete Analysemethode(n): Algorithmus, neuronales Netz(werk), DeepLearning, Machine Learning, Neuronale Netzwerke, etc.	AI as a generic term for various methods such as machine learning, data mining, neural networks, or specific algorithms. AI as a generalizing term that encompasses various analytical methods: machine learning (ML), neural networks, and deep learning (Celik et al. 2022).	"Eine auf Wahrscheinlichkeit Theorie basierte mathematische Modelle"; "Eine Netzwerk des Neuron-Verbindungen, die trainiert wird, bestimmte Aufgaben zu erfüllen."

Code 5 (inductive): AI as synonym for robotics / robots	8 - Synonym für Robotics / Roboter	Many people think that AI is synonymous with robotics (Long & Magerko, 2020, p. 3).	Künstliche Intelligenzen sind schlaue, nicht-menschliche Roboter oder Programme.
no separate code used for combinatons of several codes, codes are always named directly	9 - Mischung verschiedener Codes (dann in Kommentar Nummern konkret benennen)	Note: use as infrequently as possible	"Eine neue Tool, die nicht menschliche Intelligenz ist aber von Menschen entwickelt wurde. KI - Anwendungen befinden sich in sehr viel verschiedenen BereicheMit dieser neuen Benutzung der KI kann man leicht und schnell viele Problem / Fragen lösen und antworten." (1, 4)
Code 10 (inductive): unclassifiable	10 - nicht kategorisierbar	Answer cannot be interpreted (in terms of the codes)	"Bei der Bearbeitung des Textes ist zu beachten, dass es sich lediglich um einen Vorschlag handelt, der nicht als hervorragend bewertet werden kann. Hilfe sollte in Anspruch genommen werden." unsere Zukunft" "Computer, der gut Verlinkungen bearbeiten kann"
n.a.	n.a.	No entry / empty field or not answered	"fällt mir gerade leider nichts ein"

Appendix III

Coding of responses to open-ended questions about potential and concerns regarding the use of AI (in studies)

n = 136, frequent multiple codings

Part 1: "Where do you see the greatest potential for AI in the next 2-3 years?" Teil 1: "Worin sehen Sie das größte Potenzial von KI in den nächsten 2-3 Jahren?"		
Code	**Description (original code in German in parenthesis)**	**Number (177)**
1-1	General: AI makes life easier in various areas (Allgemein: Erleichterung durch KI in verschiedenen Lebensbereichen)	29
1-2	Completion of routine tasks (Erledigung von Routineaufgaben)	15
1-3	Generate and structure ideas (Ideen generieren und strukturieren)	13
1-4	Literature research & source work (Recherche & Quellenarbeit)	13
1-5	Data processing/ data analysis (Datenverarbeitung/-analyse)	11
1-6	Text work (formulation, correction)	11

	(Textarbeit (Formulierung, Korrektur))	
1-7	Customization of learning processes (Individualisierung von Lernprozessen)	11
1-8	Completion of creative tasks (Erledigung von kreativen Aufgaben)	9
1-9	Programming (Programmieren)	9
1-10	Translation (Übersetzung)	7
1-11	Improvement and democratization of education (Verbesserung und Demokratisierung von Bildung)	7
1-12	Despite potential, reference to risks (Trotz Potenzialen, Verweis auf Risiken)	5
1-13	General skepticism, no potential (Allgemeine Skepsis, keine Potenziale)	11
1-14	No response / I don't know (Keine Angabe / weiß nicht)	26

Part 2: "What do you consider unrealistic in terms of AI in the next 2-3 years? What concerns do you have? " (Teil 2: "Was halten Sie für unrealistisch in Bezug auf KI in den nächsten 2-3 Jahren? Welche Sorgen haben Sie? ")		
Code	**Description**	**Number (204)**
2-1	General: People are important; machines cannot do everything. (Allgemein: Menschen sind wichtig, Maschinen können nicht alles)	38
2-1a	→ People are important: grading exams (→ Menschen sind wichtig: Prüfungen bewerten)	16
2-1b	→ People are important: Learning coach/ Learning is social (→ Menschen sind wichtig: Lerncoach/ Lernen ist sozial)	10
2-1c	→ People are important: various academic activities (→ Menschen sind wichtig: verschiedene akademische Tätigkeiten)	10
2-1d	→ People are important: unique characteristics such as subjectivity, personality, emotions, and interaction (→ Menschen sind wichtig: Alleinstellungsmerkmale Subjektivität, Persönlichkeit, Emotionen und Austausch)	13
2-2	Replacing/degrading people leads to injustice (Ersatz/Herabsetzung von Menschen führt zu Ungerechtigkeiten)	21
2-3	AI use makes people lazy, dumber, and dependent (Menschen werden durch KI-Nutzung faul, dümmer und unselbstständig)	20
2-4	Fake news, falsehoods, bias, unreliability (Fake, Unwahrheiten, Bias, Unzuverlässigkeit)	16
2-5	great power of AI to the detriment of humanity (große Macht von KI zum Schaden der Menschheit)	10
2-6	Loss of value in art, etc. (collapse of the creative industry) (Wertverlust in Kunst usw. (Zusammenbruch Kreativindustrie))	7
2-7	Data protection (Datenschutz)	5
2-8	General confidence, no worries	12

	(Allgemeine Zuversicht, keine Sorgen)	
2-9	No response / I don't know (Keine Angabe / weiß nicht)	25
2-10	unclassifiable (nicht kategorisierbar)	1

МЕТАКОГНІЦІЯ І ШТУЧНИЙ ИНТЕЛЕКТ: ЩО СТУДЕНТИ ДУМАЮТЬ ПРО ВИКОРИСТАННЯ ШТУЧНОГО ІНТЕЛЕКТУ В АКАДЕМІЧНИХ ЦІЛЯХ

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Анотація
Наразі точиться широка дискусія щодо застосування інструментів на основі штучного інтелекту в академічному контексті, зокрема в галузі академічного письма студентів, а також щодо навичок, пов'язаних зі штучним інтелектом, необхідних для цих занять (див. Long & Magerko, 2020). Використання генеративного штучного інтелекту (genAI), що базується на великих мовних моделях (LLM), є дуже перспективним для полегшення освітніх процесів, особливо для студентів, для яких мова академічних досліджень не є рідною. Перехресне опитування студентів німецьких університетів (von Garrel & Mayer, 2023) показало, що приблизно дві третини респондентів вже використовували інструменти на основі genAI в зимовому семестрі 2022/23, але лише чверть робила це (дуже) часто. Релевантні дослідження переважно дали серію окремих показників використання genAI в академічних колах. Істотним обмеженням цих досліджень є відсутність будь-якого розрізнення між студентами L1 і L2. Проведене нами опитування зосереджується на потенційних групових відмінностях між студентами, для яких німецька мова є L1, і тими, для яких німецька мова є L2, а також має на меті відстежити розвиток використання інструментів на основі genAI, знання про genAI та ставлення до genAI у перші роки загальної доступності цих інструментів (2023-2025). Із цією метою було оцінено загалом 143 анкети студентів різних навчальних програм (переважно німецька мова як іноземна та друга мова) Лейпцизького університету за дворічний період. Результати опитування, представлені в цій статті, зосереджуються на обізнаності студентів та їхньому ставленні до genAI / LLM (щодо додаткових результатів див. Ketzer-Nöltge & Rüger, у друці).

Ключові слова*: штучний інтелект, генеративний ШІ, використання ШІ, грамотність у сфері ШІ, великі мовні моделі (LLM), академічні цілі, ставлення студентів, довготривале дослідження, опитування*

Декларація про конфлікт інтересів
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