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AI-mediated sensemaking in higher education students' learning processes: Tensions, sensemaking practices, and AI-assigned purposes

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Abstract

Despite a proliferation of research on generative artificial intelligence (GenAI) and its applications in higher education (HE), our understanding of the transformative processes where students create productive and ethically grounded uses of GenAI and how AI mediates students' sensemaking is still limited. Based on an empirical investigation of bachelor's degree students from educational sciences ($N = 22$) carrying out an inquiry-based course assignment, we analysed students' reflective essays to explore how GenAI mediated their sensemaking throughout the academic writing process. We selected an abductive analysis as the main approach to examine the AI-mediated construction of new understanding. Cross-tabulation analysis complemented qualitative analysis, addressing differences in AI-mediated sensemaking processes based on students' age. Our findings capture a multidimensional constellation of AI-mediated sensemaking processes. We found three central dynamics that guided students' sensemaking process: assessing and adapting the textual characteristics of AI-mediated writing, adjusting and improving interactions with GenAI, and contextualising AI-mediated academic writing experiences around everyday study practices. The tensions and ambiguities highlighted

the ethical aspects of adopting AI-mediated academic writing practices, although students did not overcome all of these tensions during their sensemaking processes. Our study contributes theoretically by developing the notion of an AI-mediated sensemaking approach, therefore adding to existing understanding about the dialogical trajectories of AI-mediated writing processes through which students create new meanings and understandings of GenAI use as a learning resource. Further, we discuss the collective aspects of AI-mediated sensemaking.

KEYWORDS

academic writing, generative AI, higher education, inquiry-process, learning, mediated sensemaking

INTRODUCTION

Advances and availability of generative artificial intelligence (GenAI) technologies have rapidly changed the practices of learning and teaching in the higher education (HE) context (Bond et al., 2024). However, it takes an effort from students to find ways to use it productively, interactively, and in ethically grounded ways (Qu et al., 2024). Current literature has shown that working with GenAI is highly interactional, and how students evaluate, interpret, and utilize it is related to the social contexts in which it is used (Bearman & Ajjawi, 2023; Chen et al., 2023; Maples et al., 2023). GenAI also transforms how students work creatively with complex problems and technology and express their skills and knowledge (Markauskaite et al., 2022; Tuomi, 2024). Academic writing plays a key role in students' learning processes to practice and express their capacities as experts solving complex problems (Lymer et al., 2024). Latest research has revealed how GenAI can become a productive resource for academic writing, such as assisting with planning, self-regulation of learning processes, and editing scientific text (Nguyen et al., 2024) or assisting students with different local-level (grammatical errors, phrasing) and global-level (text-structure, paragraph order) issues (Wang, 2024).

While the transformation of AI-mediated learning is ongoing, there is a critical need for research exploring how students navigate the complexities of using novel technologies, specifically focusing on the emergence of students' sensemaking in utilizing GenAI as a productive learning resource (Chiu, 2024). Existing studies have identified AI-assisted writing practices and student interactions, but there is a lack of comprehensive analysis of how these practices come together, building the students' experience and understanding of GenAI as a learning resource.

We focus on HE students' actions and experiences that they identify as pivotal in creating new understandings and knowledge through AI-mediated inquiry-based writing processes. We use the notion of mediated sensemaking that provides a novel framework to analyse the interactive dynamics of student-GenAI collaboration. **AI-mediated sensemaking** is defined as a process where individuals interpret and organize novel and ambiguous situations with the help of mediators, such as GenAI (Strike & Rerup, 2016; Weick, 1995). This involves analysing how students use ChatGPT during inquiry-based writing processes. The focus here is on students' actions and experiences as they interact with GenAI, identifying the tensions and ambiguities they face and the practices students adopt to overcome them. We approach

Practitioner notes

What is already known about this topic

- GenAI can provide rich support for higher education students' inquiry-based academic writing processes
- More research is needed about the transformative processes of students learning to work with GenAI
- Inquiry processes can be supported with different social and material mediators. In this study, GenAI is investigated as a sociotechnical mediator.

What this paper adds

- This paper investigates HE students' AI-mediated sensemaking in the context of inquiry-based academic writing assignments.
- Three central dynamics guided sensemaking processes, namely assessing and adapting the textual characteristics of AI-mediated writing, adapting and improving interactions with GenAI, and contextualizing AI-mediated academic writing experiences around everyday study practices.
- However, ethical tensions often remained unresolved.

Implications for practice

- By supporting GenAI use, it is possible to help students enrich their thinking about its uses and specify its purposes.
- Students interpret the outputs and role of GenAI within their collective study experiences, but also in a societal context. Dialogical practices in teaching may help students identify solutions and boundaries for GenAI use.

student-AI collaboration with the concept of **AI-mediation**, which refers to the role of GenAI as a sociotechnical agent interactively facilitating students' construction of new understandings. This emphasizes how GenAI can challenge users to understand its workings and find productive ways to collaborate with it (Bearman & Ajjawi, 2023).

The connection between AI-mediation and AI-mediated sensemaking lies in their complementary roles in student learning. AI-mediation provides the interactive support necessary for students to construct new understandings, while AI-mediated sensemaking focuses on how students interpret and organise their experiences with the help of GenAI that involves experimentation, feedback, and adaptation. Together, these concepts help to capture the multifaceted processes of how students learn to work with GenAI, from initial interactions to the final roles they assign to the AI in their learning journey. By combining these approaches, our study aims to provide a deeper understanding of how students collaborate with GenAI and the dynamics of this interaction in creative and demanding course contexts. This theoretical contribution helps to shed light on students' perspectives on AI-mediation and the evolving practices in AI-mediated sensemaking. This is a pivotal aspect in current efforts of research aiming to understand how learning processes are influenced by GenAI (e.g., Chen et al., 2023).

We investigate how 2nd-year educational sciences students ($N = 22$) at a research university use ChatGPT as a resource for their academic writing processes. The students' writing

process was structured with an assignment that scaffolded their use of ChatGPT and guided them in advancing their knowledge of the selected topics. We aim to understand students' existing capacities to work with GenAI, simultaneously shedding light on the dialogical relationship taking place while creating new understandings mediated by GenAI. Finally, we analyse the roles students assign to GenAI as a final point in their mediated sensemaking processes. We set the following research questions:

1. What kinds of tensions and ambiguities emerged from students' AI-mediated sensemaking processes?
2. What kinds of sensemaking practices emerged from students' AI-mediated sensemaking processes?
3. What kinds of purposes are students assigned for GenAI as a resource for sensemaking?

AI-mediated sensemaking

Sensemaking refers to individuals attempting to interpret and organise novel and ambiguous situations and, through the process, create new understandings (Strike & Rerup, 2016; Weick, 1995). Sensemaking evolves within reciprocal interaction with the environment by seeking cues, assigning meaning, and moving to action (Schwandt, 2005; Weick, 1995). This approach is suitable to explain how interacting with GenAI emerges in a sociotechnical context, where social norms guide how students ask questions of GenAI, and how they learn to interpret GenAI outputs and use them productively for learning (Bearman & Ajjawi, 2023). Collective sensemaking places the focus on students' actions and experiences retrospectively; therefore, it provides an important frame to analyse how students navigate the complexity of GenAI use while assigning new meanings for and creating new understandings of GenAI use (Schwandt, 2005; Weick, 1995).

Previous research on collective sensemaking and technology-mediated learning has highlighted the role of different human, material, and technological mediators in the context of change and the creation of new knowledge (Muukkonen et al., 2005; Stahl & Hakkarainen, 2021; Strike & Rerup, 2016). These mediators have a significant role in facilitating the construction of new shared understandings and adapting to change. Digital tools can take a key role as mediators through which interactions between people, groups, and artefacts take place. They can mediate both interaction and materially embodied activity, such as writing (Ludvigsen et al., 2021).

In this study, we approach GenAI as a new type of sociotechnical mediator that, through open-ended student-AI interactions, facilitates inquiry-based writing processes. While GenAI may provide students with holistic and interactive support, the accuracy and reliability of GenAI outputs remain significant challenges (Fu & Weng, 2024). GenAI tools are increasingly sophisticated, and their underlying probabilistic nature makes them challenging to understand fully. If approaching GenAI through a deterministic lens, a student may expect that identical inputs will always produce consistent outputs and may mistakenly attribute any inconsistencies or “strange behaviour” as user errors. On the other hand, if approaching GenAI through an anthropomorphic lens, a student may interpret GenAI outputs as reflections of an idiosyncratic “personality”. This natural tendency arises from our cognitive predisposition to interpret behaviour regarding intentions and emotions, even when interacting with inanimate or technological systems (Boyer, 1996). Thus, investigating the dynamics of student-GenAI interactions reveals new insights into the role of AI as a mediator of creative and demanding writing processes.

Tensions and ambiguities as a starting point of the sensemaking process

It is not self-evident that GenAI would make learning easier. Students GenAI collaboration relies on their previous knowledge and skills, highlighting the requirements to critically engage in working with such tools (Särner et al., 2024; Shibani et al., 2022). The sensemaking process includes using prior knowledge to assign new meaning to new information (Schwandt, 2005). We investigate students' AI-mediated sensemaking as an evolving process, where students successively develop their interactions with GenAI and evaluate the outputs provided by GenAI, thus leading to differently developing dynamics between students, GenAI, and written text. A critical and authentic approach to developing AI-mediated working practices can push students to think further and prioritize their voice, originality, and creativity, thus leading to high-quality and interactive learning processes (Wang, 2024).

Aligning students' GenAI knowledge, trust, and expectations with their AI-mediated interactions becomes pivotal to ensure ethically grounded, productive GenAI use (Chan & Hu, 2023). This requires students to be able to turn their experiences of interacting and working with GenAI into meaningful and comprehensible directions, to motivate strategic action, and to contribute to setting frames of reference in creative working practices (Särner et al., 2024). From students' perspective, the issues of over-trusting AI, the trustworthiness of the tools, and the transparency of AI outputs raise questions about the implications of GenAI use and users' AI capabilities (Alfredo et al., 2024; Chiu, 2024). To better understand the evolving dynamics of student-AI interactions, we capture the (1) tensions and ambiguities students retrospectively identify from AI-mediated inquiry processes and (2) the ways students overcome these tensions and ambiguities. Tensions and ambiguities make visible the perspectives through which students' sensemaking processes develop within their experience of the AI-mediated inquiry process. Thus, they are pivotal to tracing what kind of prior knowledge students use to create order and a new understanding of the dynamics of working with GenAI.

In this study, *tensions* refer to moments where the students explicitly confront their expectations or perceptions of how they plan to use GenAI in different phases of inquiry or juxtapose their ideals of academic writing with the use of GenAI (Cherbow & McNeill, 2022). *Ambiguity* refers to moments when students express a lack of clarity regarding the relevant functions of GenAI or their working dynamics with GenAI. Students can negotiate their relationships with GenAI by exploring ways to utilize GenAI to augment their thinking and creativity (Chen et al., 2023). In this study, students engage in AI-mediated *sensemaking practices* when they try to negotiate tensions and resolve ambiguity between their plans and goals for using GenAI in inquiry processes and their enactment with GenAI to overcome these tensions and ambiguities (Cherbow & McNeill, 2022).

Purposes of AI

GenAI is seen as a functional tool helping with content-focused issues, while at the same time, it is perceived as a human-like figure conveying different needs, expectations, and differentiating uses (Maples et al., 2023). The purposes of GenAI are negotiated in terms of its agency, ability to complement or replace human support, and students' capacities to interact with it (Molenaar, 2022). These uses have been described as human-AI collaboration, referring to students' ways of using AI interactively, expecting AI to help them advance their thinking and understanding, expressing empathy, and being able to respond to their different support needs (Nguyen et al., 2024; Sharples, 2023). Furthermore, research has identified

transactional uses, referring to students' tendencies to use GenAI in the same ways as previous technologies, such as search engines and translators (Cukurova, 2025). However, the best purposes and practices are still emerging. For example, Maples et al. (2023) use the concept of the intellectual mirror, describing how students could use GenAI to have external dialogues with themselves. By investigating the purposes and roles students assign for GenAI, it is possible to understand how they see such an open-ended and interactional tool in their study contexts.

METHODS

Context

The participants ($N = 22$) were 2nd-year students from educational sciences (3 male, 19 female). Their age varied from 20 to 46 ($M = 25.5$, Md = 22 years). Students participated in the six-week mandatory course *Psychology of Learning I* (5 ECTS). Working in the course was structured through 12 interactive lectures, readings, a collaborative course project, and an individual essay assignment. Learning objectives of the course were (1) to understand the basics of individual learning processes, (2) to recognize factors that influence learning processes, (3) to describe different forms of expertise, (4) to understand the basics of technology-enhanced learning, (5) to recognize the principles of learning analytics and AI use in educational contexts, and (6) to be able to analyse learning processes and contexts through different theoretical approaches. The first author of this paper was the responsible teacher of the course. Participation in the data collection was voluntary. Students were asked for consent to use their contributions for research after completing the course. We adhered to the ethical guidelines of the university, and since the study did not meet the criteria for requiring a separate ethical review, it was not conducted.

Design of the study

An inquiry-based essay assignment was developed for the course. The assignment held twofold learning goals: (1) students identifying ethically grounded and productive ways to work with GenAI, and (2) deepening their understanding of the topic they selected for their essay. The essay assignment was divided into four steps (see Figure 1).

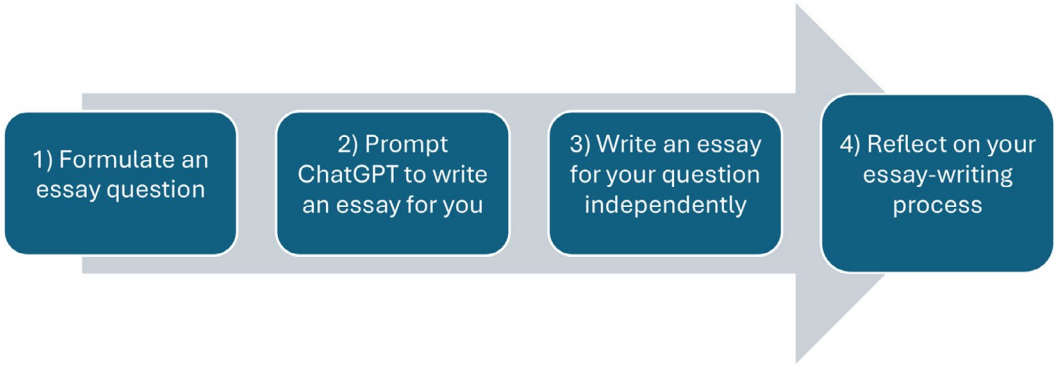

FIGURE 1 Instructional phases of the essay-writing assignment.

We selected an inquiry-based approach to promote students' agency in thinking and experimenting with the productive and ethical uses of GenAI through the writing process (Muukkonen et al., 2009). (1) The questions students formulated in the first phase of the inquiry guided their GenAI prompting, independent essay writing, and the whole inquiry process. Students were instructed to choose a course topic they would like to learn more about. The students selected topics, such as scaffolding, theories of motivation or emotions, self-regulation of learning, or applying to university. Students were then asked (2) to instruct ChatGPT, or a similar LLM-based chatbot (Bing or Copilot), to prompt a three-page essay on a question they had created. Prompting was expected to allow them to identify the strengths and limitations of GenAI-generated text and see the influence of their prompts on working with GenAI. In the next phase, (3) the students were asked to write the essay themselves, using the digital resources of the university library and their scientific writing methods. At the final stage, (4) students were asked to reflect on their essay writing process using seven reflective questions (see Appendix A):

- Was the essay generated by GenAI reliable?
- What kinds of references did GenAI use?
- What kinds of issues did GenAI highlight?
- What did the GenAI leave out?
- How would you describe the essay as a result of your collaboration with GenAI?
- How could you use GenAI in your studies in the future? What are the challenges involved?

The use of GenAI poses a new challenge for evaluating students' academic integrity, as there is a risk that students cheat by copying and pasting their assignments from GenAI-generated texts. In this process, prompting an essay with AI was one part of a four-phase assignment. Overall, the inquiry process required students' critical reflection based on their knowledge and experiences.

Data analysis

Final essay scores and phase four (see Figure 1), the reflective parts, were selected for the qualitative analysis. The third author blindly assessed assignments. The score reflects the overall quality of the four phases of the assignment. The essay score included an evaluation of how well the inquiry question was formulated (Title), how students used references in their own essay (Use of References), how systematically their essays were argued and outlined (Systematicity), and how students applied the knowledge gained and reflected on the writing experience in the fourth phase (Application). Thus, the assessment focused on the inquiry processes reported by students and considered students' use of GenAI as part of the success of the assignment. Students could receive 1 to 3 points in each category, and the final Essay Score was a sum of these points. Two classes were created for each analysed variable, namely essay score, gender, and age (see Table 1).

The qualitative analysis focused on the students' reflections (phase 4). An abductive approach (Tavory & Timmermans, 2014) was applied to analyse qualitative data. The focus of the analysis was on (1) the tensions and ambiguities students identified, (2) the practices students created to overcome identified tensions and ambiguities, and (3) the purposes students assigned for GenAI use as a resource for learning (Cherbow & McNeill, 2022; Furberg et al., 2013, see Table 2). The focus of purposes was operationalized based on the current literature on the students' AI perceptions and expectations of GenAI, acknowledging the interactive nature of GenAI (Bearman & Ajjawi, 2023; Cukurova, 2025; Maples et al., 2023,

TABLE 1 Overview of participants and variable classification.

Participants	*N*	%
Age		
≤22	13	59
>22	9	41
Gender		
Male	3	14
Female	19	86
Essay score		
High (9–11 points)	13	59
Low (5–8 points)	9	41
Total	22	100

TABLE 2 Category descriptions of main and subcategories.

Category	Description
1. Tensions and ambiguities	Experiences, attitudes, and perceptions incompatible with students' experience of the AI-mediated inquiry process. Lack of clarity regarding relevant functions of GenAI
1a. Text accuracy and transparency	Tensions and ambiguities students addressed regarding the content, structure, and transparency of the text prompted with ChatGPT
1b. Incompatible expectations and perceptions of GenAI	Experiences that reflected students' incompatible expectations of AI-mediation, misconceptions of AI
1c. Challenges and concerns of equal and safe AI use	Concerns and challenges regarding their own or collective skills, knowledge, and motivations required to use AI, and ethical concerns regarding the implications of AI use for learning
2. Sensemaking practices	Practices and approaches students described explaining how they overcame the tensions and ambiguities they encountered
2a. Efforts to overcome text-related tensions	Students' efforts and decisions to overcome the tensions and ambiguities regarding the text's accuracy and transparency
2b. Adaptations of AI interactions and reasoning how AI works	Re-structuring interactions with GenAI or creating new approaches to interact and understand GenAI
2c. Contextualizing AI-mediated writing process	Contextualizing AI-mediated writing process with their collective and individual practices of studying and academic writing
3. Purposes of AI use	Meanings that students assigned to AI mediating their inquiry processes
3a. Human-AI collaboration	Assigned roles of GenAI that have an interactional nature, including shared advancement of knowledge, dialogical perspectives, or human-like characteristics attributed to GenAI
3b. Transactional use	Roles of GenAI that replicate the ways other technologies, such as search engines, translators, or text editors, are being used
3c. No specific role	Students expressed a positive attitude towards using GenAI to support learning, but no specific roles were identified

see Table 2). Current literature on the use of ChatGPT as a learning support was used to formulate the subcategories (Chen et al., 2023; Nguyen et al., 2024; Wang, 2024, see Table 2).

The unit of analysis varied from one word to one sentence. No overlapping between categories was allowed. The coding scheme was developed iteratively, and the reliability of the analysis was improved by two researchers who independently coded the same 10% of the analysed utterances. After this, disagreements were negotiated, and categorization was clarified. Cohens' kappa value was calculated ($\kappa = 0.90$), indicating high inter-rater reliability. Finally, cross-tabulation analysis was conducted using a chi-square test to examine the relationship between coded categories and students' age, gender, and essay scores.

RESULTS

RQ1. What kinds of tensions and ambiguities emerged from students' AI-mediated sensemaking processes?

The tensions and ambiguities students described focused on (1a) text accuracy and transparency, (1b) incompatible expectations and perceptions of GenAI, and (1c) gaps in students' capabilities to work with GenAI (see Table 3).

Text accuracy and transparency focused on ambiguities of text content, structure, and text reliability. For example, students described that the text prompted with GenAI consisted of short paragraphs, and the flow of the text was not always clear: *"In particular, the AI-generated" conclusions "section is confusing, as it is only two sentences long."* Students described that text was sometimes written on a superficial level, or the contents were described on a more superficial level than expected. Furthermore, students found it difficult that GenAI could not provide concrete examples, nor was it a very creative writer: "*The paragraphs are long and at times, at least for me, I felt that it was difficult to keep hold of the thread. A lot of the things I would have liked to have covered in more detail had to be mentioned only superficially*. "An ambiguous issue for students was that they could not trace the references GenAI was using in AI-prompted texts. Thus, it was difficult for students to assess the reliability of the text:" *It is difficult to assess the reliability of the AI essay, as it does not reveal its sources of information*."

TABLE 3 Subcategories of tensions and ambiguities and cross-tabulations with age, gender, and essay score.

Tensions and ambiguities ($f = 127$)					
	Text accuracy and transparency	**Incompatible expectations and perceptions of AI**	**Challenges and concerns of equal and safe AI use**	χ^2	*p*
f	46 (36.2%)	49 (38.6%)	32 (25.2%)		
Age				6.14	0.046*
≤22	25 (30.9%)	30 (37.0%)	26 (32.1%)		
>22	21 (45.7%)	19 (41.3%)	6 (13.0%)		
Gender				1.07	0.59
Male	8 (42.1%)	8 (42.1%)	3 (15.8%)		
Female	38 (35.2%)	41 (38.0%)	29 (26.9%)		
Essay score				3.41	1.82
High	28 (36.8%)	33 (43.4%)	15 (19.7%)		
Low	18 (35.3%)	16 (31.4%)	17 (33.3%)		

*$p < 0.05$.

Further ambiguities and tensions were caused by students' incompatible expectations and perceptions of GenAI. For example, while students were aiming to write scientific text, GenAI could not fulfil the criteria of scientific text. GenAI did not provide text that sufficiently answered their requests in terms of theoretical content. Students also reported that AI could not add human-like experiences to the text: "*There are also many limitations to AI, such as the fact that AI is not (or at least not yet) as capable of bringing the human experience to the text*." In addition, tensed expectations and perceptions reflected various preconceptions and concerns created by the current AI debate, such as talk of academic cheating and the replacement of human labor with AI: *"I think it is clear that this version of GPT cannot yet create a text that can be used in an academic context to cheat,"* "*However, I do not believe that it can replace human discussion and reflection*."

Third, students discussed multiple *challenges and concerns of equal and safe AI use* and elaborated on different collective and individual implications that AI use might cause. For example, students addressed ethical challenges in terms of equity, stating that students who are good at using AI for learning will benefit from these tools over those who do not want or know how to use AI productively for learning: "*The use of AI can put students on unequal positions, with some using it a lot and others not using it at all, for example*.", and: "*Some students have spent several hours writing an essay, while others use AI to create a text just as good, if not better, in five minutes*."

Students also reported a lack of capabilities to use AI productively, for example, to evaluate its reliability or provide better prompts, and were concerned over what AI use might cause study behaviours in the long run: "*However, the challenge would be to get" hooked* "*on AI and look at all the answers there first, rather than using your own thinking*."

The chi-square test results indicate a significant association between students' age and the tensions and ambiguities they identified. Students aged 22 or younger reported more concerns and tensions regarding equal and safe AI use than students over 22. Overall, younger students identified more tensions and ambiguities across all identified subcategories.

RQ2. What kinds of sensemaking practices emerged from students' AI-mediated sensemaking processes?

The analysis focused on identifying the aims and focuses that guided the sensemaking. Students identified (2a) efforts to overcome text-related tensions and ambiguities, (2b) adaptations of interactions with AI and reasoning of AI functionality, and (2c) efforts to contextualise their AI-mediated writing experiences based on their individual and collective everyday study practices (see Table 4).

The most common sensemaking practices were efforts to overcome text-related tensions (see Table 4). Students ensured the reliability of the GenAI-generated text by cross-checking the contents from other references: "*When using AI, it seems that you have to do much checking with the original sources to make sure that this is correct, and that the AI has understood the concepts and the text as a whole correctly*." They also compared GenAI outputs to their text to improve the content accuracy and applied critical literacies to evaluate GenAI-generated text: "*In my own essay, I briefly highlight the role of technology, particularly in AI scaffolding. The essay by AI does not highlight the specific role of technology in scaffolding but focuses more on pedagogical strategies in general."* These practices helped students to utilize text provided by AI as a basis for what they wrote, to reflect on their ideas and knowledge, and to specify their thinking about the selected topics.

Second, students made *adaptations to their AI interactions and reasoned about how AI works*. If students did not receive the output they expected, they improved or iterated their prompts and tried a different approach to asking for help from GenAI: *"My next idea was to*

TABLE 4 Subcategories of sensemaking practices and cross-tabulations with age, gender, and essay score.

Sensemaking practices ($f = 172$)					
	Efforts to overcome text-related tensions	**Adaptations of AI interactions and reasoning how AI works**	**Contextualizing AI-mediated writing process**	χ^2	p
f	89 (51.7%)	62 (36.0%)	21 (12.2%)		
Age				15.98	<0.01*
≤22	61 (66.3%)	23 (25.0%)	8 (8.7%)		
>22	26 (35.1%)	36 (48.6%)	12 (16.2%)		
Gender				0.37	0.83
Male	15 (50.0%)	12 (40.0%)	3 (10.0%)		
Female	72 (52.9%)	47 (34.6%)	17 (12.5%)		
Essay score				0.24	0.88
High	47 (51.1%)	33 (35.9%)	12 (13.0%)		
Low	40 (54.1%)	26 (35.1%)	8 (10.8%)		

*$p<0.05$.

ask ChatGPT to write the text as if it had been written by a second-year university student." Students also tried to find an explanation for the unexpected output that AI provided based on what they knew about GenAI functionality: *"I believe that the difference between AI in this respect is very much related to the fact that its limitations are built on what information and algorithms it has learned."*, and*: "I realized that ChatGPT can even come up with sources on its own."*

As a third practice, students aimed to *contextualize AI-mediated writing experience* to their everyday study and academic writing practices. Thus, students elaborated on their writing practices, collective study practices, and norms and considered how these practices were reflected in their AI-mediated experience: *"However, in this case, your vision often needs to be quite clear in order to get the result you want."*, and*: "I have always enjoyed discussing ideas and thoughts out loud during the writing process"* Students also aimed to find approaches to work with GenAI from institutional guidelines or professionals' ways of using GenAI for writing. Finally, some students reflected on their AI-mediated writing experience by recalling their understanding of the given task: *"Assignment on finding relevant theories (and comparison) was not a straightforward list task, but rather a question requiring a personal perspective*." These practices helped students to understand the challenges they had faced through the writing process, such as specifying task understanding or identifying ethical perspectives on AI use.

The chi-square test results indicate a significant association between students' age and the sensemaking practices they applied. Students aged over 22 reported more often sensemaking practices that contextualised their AI-mediated writing experience into everyday practices than students aged 22 or less. Their representation was higher in adapting and improving GenAI interactions, whereas students aged 22 or less were found to focus their sensemaking practices on efforts to overcome text-related tensions.

RQ3. What kinds of purposes are students assigning for GenAI as a resource for sensemaking?

Besides how students reflected on how they worked and experimented with GenAI during the assignment, they considered how they would work with it in future tasks. Students assigned multiple purposes to GenAI. Three different subcategories were identified from

TABLE 5 Subcategories of Assigned purposes and cross-tabulations with age, gender, and essay score.

Assigned purposes (*f* = 87)					
	Human-AI collaboration	**Transactional use**	**No specific role**	χ^2	***p***
f	41 (47.1%)	26 (29.9%)	20 (23.0%)		
Age				3.15	0.21
≤22	21 (41.2%)	15 (29.4%)	15 (29.4%)		
>22	20 (55.5%)	11 (30.6%)	5 (13.9%)		
Gender				NA	NA
Male	6 (75.0%)	0 (0.0%)	2 (25.0%)		
Female	35 (44.3%)	26 (32.9%)	18 (22.8%)		
Essay score				0.41	0.82
High	26 (50.0%)	16 (30.8%)	10 (19.2%)		
Low	15 (44.1%)	10 (29.4%)	9 (26.5%)		

student reflections, addressing how GenAI use purposes may have their focus on (3a) human-AI collaborative interactions, (3b) transactional uses, and (3c) accepting the use of GenAI, while not giving it any specific purpose (see Table 5).

The first category, *Human-AI collaboration*, included roles that reflected students' intention to interact with GenAI in ways that support their problem-solving and knowledge creation, thus referring to a perception of a highly creative technology. These roles included ideas of using GenAI to create a structure for their text, discussing different research ideas with GenAI, helping them to get a better understanding of certain topics, or creating a baseline that helps elaborate individual ideas and experiences:

> *It could be used to create some kind of general understanding of a phenomenon*.
>
> *For example, AI can be used when you feel like you don't know how to approach a topic, for example, in an essay*.
>
> *I think you could try using AI to create an essay, for example, by first discussing the topic in a wide-ranging way and then asking the AI to create an essay that draws on the perspectives and views that emerged from the discussion*.

The second category, *transactional use*, describes such roles where students transferred ways of using other technologies, such as translators and search engines, to working with AI (see Table 5). For example, students described GenAI as working well in translating scientific articles: *"Nevertheless, AI is useful to me, especially for translating English-language articles*." They also used AI in editing their texts or searching for new information: *"I find AI to be a good tool for summarizing text and creating definitions*," and: *"AI is also a useful tool for acute information searches."*

Finally, some students identified that GenAI can be important in supporting learning and useful in academic contexts. However, they did not specify any specific purposes for their future GenAI use: *"For example, using AI to facilitate learning," "Above all, generative AI should be used mainly as a support."*, and*: "I would argue that despite its problems, AI has a place in the academy."* While the purpose was unclear, students still positioned GenAI as a support and helping them learn. These roles indicated a positive attitude towards GenAI use as a student.

No statistically significant associations were found between the assigned roles and students' gender, age, or essay score.

DISCUSSION

The results of this study address that the relational dynamics of students' AI-mediated sensemaking processes are multilayered, consisting of the dialogue that focuses on students' writing processes and creating scientific text, evolving understandings and interpretations of GenAI and its' outputs, and broader social and ethical considerations. The emphasis of sensemaking practices was on overcoming text-related tensions and ambiguities or iterative adaptations on the prompts and interactions with GenAI, while only 12% of the reported sensemaking practices focused on contextualizing GenAI use more collectively. Therefore, it is notable that especially tensions related to ethics and social consequences remained unresolved, whereas tensions related to students' own capabilities were further reflected as different roles assigned for GenAI as a learning resource and as identified knowledge gaps.

Current literature has discussed the importance of GenAI conceptualizations and roles for achieving human-AI hybrid intelligence (Cukurova, 2025). The analysis of the roles assigned

for GenAI as a learning resource revealed that at the end of their AI-mediated sensemaking processes, students recognized multiple roles for GenAI that reflected collaborative and reciprocal dialogues between students and GenAI, and where the idea of an intellectual mirror could be identified (Maples et al., 2023). However, students also reported multiple transactional roles assigned for GenAI that they considered useful. In the context of transformative sensemaking processes, these roles were beneficial for students, suggesting that the ways GenAI can be supportive of learning are multidimensional. 20% of the identified utterances regarding GenAI roles did not assign any specific role for GenAI, but students still expressed a positive attitude towards using it as a learning resource. These findings align with previous literature identifying multiple forms of human-AI collaboration (Cukurova, 2025; Chen et al., 2023). Similarly, they highlight the importance of looking at students' AI-mediated sensemaking beyond single conceptualizations and rather as part of educational practices.

Students' age was associated with the identified tensions, ambiguities, and sensemaking practices. Younger students identified more tensions and ambiguities across all subcategories, whereas older students more often focused their sensemaking practices on improving interactions with GenAI or contextualizing them into everyday study practices. In this study, the participants were already age 20 or above. The differences between age groups could refer to students' academic experience or their academic writing and reading skills. Further research is needed to study more junior higher education students.

Limitations

This study has limitations that should be acknowledged. First, the study was conducted as a part of the course focusing on the psychology of learning, which may have influenced students' thinking about the role of GenAI in learning. Second, the number of participants remains small, limiting the generalizability of the results. The gender distribution of the study (Male 3, Female 19) represents a typical distribution for the student group of educational sciences in the Finnish HE context, but it was not meaningful to make inferences based on the statistics regarding gender. Further, information on participants' prior experiences with GenAI tools would have enriched the analysis of the study and interpretation of the findings. The findings provide insights into the important group of GenAI users. Recently identified field-specific and gender-related differences in HE students' attitudes towards and uses of GenAI suggest that female students in fields such as humanities and social sciences might have more critical attitudes and more concerns towards GenAI compared to male students in fields such as engineering and sciences (Qu et al., 2024; Stöhr et al., 2024). Understanding the sensemaking processes of educational sciences students with a female majority may offer new insights to increase equal uses of GenAI as a learning support across fields and genders.

This study contributes to the theory of mediated sensemaking by analysing GenAI as a mediator in the sensemaking process. This framework highlighted the role of dialogical processes students developed with the open-ended, sociotechnical agent. AI-mediation emerged as focusing on the writing processes, dialogical developments within the problem space, and as a holistic learning support helping students to structure and externalize their thinking about their writing processes. Further, the notion of mediated sensemaking helped to make visible how student-AI collaboration emerged as continuity from identifying tensions to reflect GenAI purposes on multiple levels, highlighting the importance of looking at these transformative processes to understand how students create new meanings and understandings for working with GenAI. The study also highlighted the key aspects and knowledge students utilize in their sensemaking processes when working with GenAI. Such

understanding is important for educators to identify the student-centered aspects of productive and ethical uses of GenAI.

CONCLUSIONS

This study exemplifies that analysing multilayered processes of AI-mediated sensemaking is pivotal to understanding how GenAI becomes a part of students' complex and creative problem-solving practices. AI-mediated sensemaking provided an important frame to identify how students' understandings and meanings of GenAI evolved throughout the process and how the dialogues of these meanings evolved between students, GenAI, and the writing assignment, but also within a social context. These findings suggest further attention should be given to socio-material and sociocultural approaches to investigating student-AI collaborations (Tietjen et al., 2023).

This study proposed how social context and broader societal discourse of GenAI may influence the challenges and possibilities students identify when working with GenAI. To better understand how GenAI influences HE students' writing processes and decisions, it is critical to elaborate further on the differences in students' thinking and use of GenAI based on individual characteristics such as previous knowledge, age, gender, and academic performance, but also to identify the varying use practices within different epistemic cultures and sociocultural contexts (Markauskaite et al., 2022; Qu et al., 2024).

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CONFLICT OF INTEREST STATEMENT
The authors declare no conflicts of interest related to this work.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT
The data used in this study cannot be made publicly available due to its confidential nature. However, aggregated or anonymized insights may be shared upon reasonable request, subject to legal and ethical considerations.

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APPENDIX A

1. Instructions for the essay assignment

First, create an essay assignment for yourself. Choose one key learning concept/theory from this course (e.g., emotion regulation, socially shared regulation of learning, attribution theory, scaffolding, etc.). Write a scientific essay on the concept/theory you selected. In your essay, summarize the key perspectives and theories related to the concept. Describe how the concept manifests or emerges in different practical contexts. Consider what aspects you would like to emphasize in the essay assignment. The essay may reflect the writer's views, experiences, and perceptions. Express the essay topic as a 1–2 sentence assignment or question.

Then proceed with the essay assignment through the following three steps:

2. AI essay (approximately three pages)

3. Self-written essay (about three pages + sources)

Ask a GenerativeAI, such as ChatGPT, to write an essay for you based on the conditions you provide: your own essay assignment and length. You can also specify your prompts, such as language and references, and see how GenAI performs on these preferences.

Write an essay of about three pages based on the guidelines you have provided. Make use of scientific sources and course literature in the essay. In this assignment, try to structure your own thinking and use the GenAI output only in the next step.

4. Reflection on an essay writing process with GenAI (1-2 pages)

In this step, compare and reflect on the differences and similarities between an essay you have written and an AI-generated essay and the potential of generative GenAI as a co-author of a scientific text. Also, the potential limitations of GenAI should be considered.

You have now written your own essay on your assignment and have an AI-generated essay. Compose a reflection in which you reflect:

- Did GenAI generate the essay reliably?
- What kinds of references did the GenAI use?
- What kinds of issues did the GenAI highlight?
- What did the GenAI leave out?
- How would you describe the essay as a result of your collaboration with GenAI?
- How could you use GenAI in your studies in the future? What are the challenges involved?

Your reflection should be 1–2 pages in length. Therefore, the total length of the assignment is three pages for the GenAI essay, three pages for your essay, and 1–2 pages for your reflection. The total length of the assignment is 7–8 pages + sources.