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From AI Literacy to Epistemic Agency

How GenAI Re-shapes Writing Pedagogy in Engineering Education

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Abstract

This paper explores how instructional design can scaffold epistemic agency in generative AI (GenAI)-mediated scientific writing. Embedded in a design-based research (DBR) framework, it draws on two iterations of a redesigned Scientific Writing course at the Zurich University of Applied Sciences (ZHAW), where engineering students engaged with GenAI tools throughout the writing process. A qualitative case study examines one group's prompting journal and final text using two exploratory coding schemes grounded in established models of media competence and agency. The analysis of the prompting journal shows reflective and ethically grounded engagement with GenAI, marked by decision-making, evaluation, and self-regulation. The student text evidences epistemic positioning, reasoning, and reflection through structured argumentation, methodological transparency, and ethical awareness. Together, these findings suggest that instructional scaffolds such as prompting journals and iterative reflection, can externalise epistemic processes and strengthen AI literacy as a foundation for epistemic agency. The study contributes to developing transferable pedagogical models for responsible GenAI integration in higher education.

Von KI-Kompetenz zu epistemischer Handlungsfähigkeit. Wie genKI die Schreibdidaktik in der Ingenieurausbildung neu gestaltet

Zusammenfassung

Dieser Artikel untersucht, wie Unterrichtsgestaltung die epistemische Handlungsfähigkeit beim wissenschaftlichen Schreiben mithilfe generativer KI (genKI) fördern kann. Eingebettet in einen designbasierten Forschungsrahmen (DBR) stützt er sich auf zwei Iterationen eines neu gestalteten Kurses zum wissenschaftlichen Schreiben an der Zürcher Hochschule für Angewandte Wissenschaften (ZHAW), in dem Ingenieurstudierende während des gesamten Schreibprozesses mit genKI-Tools arbeiteten. Eine qualitative Fallstudie untersucht das Prompting Journal und den abschliessenden Text einer Gruppe anhand von zwei explorativen Kodierungsschemata, die auf etablierten Modellen der Medienkompetenz und

Handlungsfähigkeit basieren. Die Analyse des Prompting Journals zeigt eine reflektierte und ethisch fundierte Auseinandersetzung mit genKI, die durch Entscheidungsfindung, Bewertung und Selbstregulierung gekennzeichnet ist. Der Text der Studierenden zeugt von epistemischer Positionierung, Begründen und Reflexion durch strukturierte Argumentation, methodische Transparenz und ethisches Bewusstsein. Zusammengefasst deuten diese Ergebnisse darauf hin, dass didaktische Hilfsmittel wie Prompting Journals und iterative Reflexion epistemische Prozesse externalisieren und die KI-Kompetenz als Grundlage für epistemische Handlungsfähigkeit stärken können. Die Studie leistet damit einen Beitrag zur Entwicklung übertragbarer pädagogischer Modelle für die verantwortungsvolle Integration von genKI in die Hochschulbildung.

1. Introduction

Scientific writing is a core practice in higher education, serving not only to communicate but also to construct and negotiate knowledge (Chen 2019). In Europe, systematic writing instruction developed later than in the U.S., gaining curricular space through the Bologna reform and competence-oriented approaches such as *Writing Across the Disciplines* (WAC) and *Writing in the Disciplines* (WID) (Carter et al. 2007; Kruse 2013). Disciplinary variation remains strong: while the humanities have long foregrounded writing as epistemic practice, in engineering it still plays a secondary role – a disparity now amplified by the emergence of generative AI (GenAI).

Since ChatGPT's release in 2022, GenAI has rapidly transformed academic writing, with most students now using such tools for brainstorming and drafting (Cieliebak et al. 2023; Kelly et al. 2023; Stöhr et al. 2024; Helm and Hesse 2024). While these systems can enhance linguistic fluency and support non-native writers (Song and Song 2023; Utami et al. 2023), studies also note difficulties with critical reflection and responsible use. This ambivalence calls for pedagogical approaches that cultivate students' ability to remain epistemically responsible authors when collaborating with GenAI.

Responding to this challenge, an existing Scientific Writing course at the Zurich University of Applied Sciences (ZHAW) was redesigned in 2023 to integrate GenAI purposefully throughout the writing process.¹ Each semester about 600 engineering students participate in approx. 20 classes taught by 8–12 lecturers, working in small groups on joint research papers. The first iteration (2024) systematically introduced GenAI tools across the writing phases through short inputs and guided workshops, complemented by coaching feedback and a mid-term survey (Schnatz and Bieri 2024). The second iteration (2025) added two refinements: (1) a prompting journal enabling students to document and reflect on their GenAI collaborations, and (2) self-study units on genre and

¹ Course structure: 14 weeks, each session combined a short input with a workshop task aligned to a specific writing phase; student groups submitted a proposal (week 4) and an abstract with draft sections (week 10); feedback was provided through individual coaching.

rhetoical structure (e. g., introductions following Swales' CaRS model; [Swales 2014]).² Both elements aimed to strengthen students' epistemic agency – their capacity to control, justify, and integrate GenAI-generated information deliberately within academic writing (Schnatz and Bieri 2025).

Building on this iterative design, the present paper explores how epistemic agency can be fostered and empirically traced in GenAI-supported scientific writing. While earlier studies analysed students' perceptions and GenAI tool use, this study adopts a process-oriented lens to examine how learners make and justify epistemic decisions during collaboration with GenAI.

The study addresses two questions:

- (1) How can instructional design scaffold epistemic agency in GenAI-mediated writing tasks?
- (2) Which indicators of epistemic agency emerge in students' prompting journals and final texts?

The paper first develops the theoretical framework for conceptualising epistemic agency in GenAI-supported writing (Chapter 2) and then outlines the design-based research setting in which this framework was operationalised and examined (Chapter 3). It subsequently presents the exploratory empirical analysis of a selected student group's prompting journal and final text (Chapter 4) and concludes with a discussion of the implications of the findings (Chapter 5).

2. Theoretical background

This chapter situates the study within current debates on scientific writing, GenAI, and media pedagogy. It conceptualises writing as an epistemic practice and examines how GenAI reshapes this practice, calling for renewed pedagogical attention to AI literacy and epistemic agency. Throughout the chapter, Baacke's (1996) model of media competence functions as the overarching pedagogical framework, linking AI literacy and epistemic agency by emphasising reflective, responsible action in mediated contexts. On this basis, the chapter develops a conceptual framework for analysing how epistemic agency can be fostered and empirically traced in GenAI-supported writing.

2 The prompting journal followed a four-column template shown in Table 1 in section 2.3 (tool | purpose | prompt | results & reflection); the self-study units on Moodle combined short genre explanations, annotated examples, and micro-tasks.

2.1 *Scientific writing as epistemic practice*

Scientific writing is a core epistemic practice in higher education, as it is through writing that knowledge claims are articulated, evaluated, and legitimised within disciplinary communities (Kruse et al. 1999; Pohl 2016). This epistemic function presupposes a close alignment between authorship, reasoning, and textual production, as writers are held responsible for the justification and validity of the claims they advance.

The pedagogical status of scientific writing has nevertheless varied across higher education contexts. In higher education in the German-speaking countries, systematic writing instruction emerged comparatively late and has often remained marginal within disciplinary curricula (Kruse et al. 1999; Pohl 2016). Anglo-American traditions established writing earlier as an academic competence linked to disciplinary knowledge making (Carter et al. 2007; Chen 2019). The Bologna reform created curricular space for competence-oriented instruction (Frank et al. 2013), yet writing remains marginal in many disciplines, particularly in engineering, where it is often treated as secondary to technical problem-solving despite the epistemic demands of core genres such as lab reports, technical documentation, and research articles (Riewerts 2016).

Writing competence therefore includes the capacity to formulate questions, evaluate evidence, and justify claims in ways that are accountable to disciplinary standards. In this sense, writing instruction implicates epistemic agency, even when it is not named as such. With the diffusion of GenAI tools, this alignment becomes fragile, since core acts of reasoning, structuring, and justification can be partially delegated to algorithmic systems. This shift makes it necessary to re-focus writing pedagogy on how epistemic responsibility is maintained under GenAI-supported conditions.

To analyse how GenAI enters this practice, this paper distinguishes between media-related tool use and epistemic collaboration. Tool use refers to the instrumental selection and deployment of GenAI systems for specific purposes, such as drafting, revising, or language checking, and captures how GenAI functions as a medium within writing practices. Tool use, in this sense, describes patterns of adoption but does not by itself explain how epistemic decisions are made. Epistemic collaboration denotes situations in which AI-generated suggestions become part of epistemic decision-making, for instance when writers evaluate, accept, modify, or reject proposed claims. Collaboration is used descriptively and does not imply shared agency or intentionality, but points to moments in which epistemic responsibility may become blurred and therefore requires explicit reflective regulation.

2.2 *GenAI in higher education*

Since 2022, applications such as ChatGPT, Elicit, and DeepL Write have rapidly entered academic practice, reshaping how students plan, draft, and revise their texts (Cieliebak et al. 2023; Helm and Hesse 2024; Kelly et al. 2023; Rapp et al. 2025; Ravšelj et al. 2025;

Stöhr et al. 2024). For engineering students, GenAI tools offer support in a domain often perceived as secondary to their technical expertise, potentially lowering barriers to engagement with writing. Stöhr et al. (2024) found that male students, particularly in engineering disciplines, reported higher GenAI use than their peers. Yet uncritical reliance carries the risk of cognitive offloading (Gerlich 2025) and epistemic shortcuts, where essential acts of reasoning, structuring, and argumentation are delegated to machines. Gerlich (2025) further demonstrates that these risks are unevenly distributed: while experienced writers tend to use GenAI systems to support planning and revision without relinquishing epistemic control, novice learners are more likely to offload epistemically relevant decisions, particularly those related to argument development and justification. From a research ethics perspective, Resnik and Hosseini (2025) likewise emphasise that epistemic responsibility for claims, interpretations, and justifications must remain with human authors, as GenAI systems cannot bear epistemic or moral responsibility. This ambivalence calls for didactic approaches that explicitly address epistemic responsibility, moving beyond both prohibition and unreflective adoption toward forms of GenAI use that preserve authorial judgement.

In higher education, this development directly affects the conditions under which epistemic agency – understood as learners’ capacity to deliberately steer, justify, and take responsibility for their knowledge-making processes (see section 2.3) – can be exercised. When GenAI systems participate in the production of academic texts, the evaluation and justification of claims can no longer be taken for granted as authorial achievements. Writing pedagogy therefore faces the task of explicitly addressing epistemic responsibility, ensuring that students remain accountable for knowledge claims even when GenAI systems are involved.

A promising response lies in the concept of AI literacy, which frames GenAI not as a technical aid but as a context for developing critical, reflective, and ethical competences. In scientific models, Long and Magerko (2020) define AI literacy as encompassing cognitive, social, and ethical dimensions of GenAI understanding and collaboration, while policy frameworks such as the UNESCO AI Competency Framework (2024) translate these competences into educational guidelines.

The present study draws on these models but situates them within Baacke’s (1996) model of media competence, which conceives media competence as reflective *Handlungskompetenz* – the ability to act autonomously and responsibly in mediated environments. From this perspective, the purposeful integration of GenAI tools into writing instruction is not a technical issue but an educational one: it prepares students to act competently in GenAI-mediated academic and professional contexts. Epistemic agency represents the domain-specific expression of this competence, focusing on learners’ ability to take deliberate control of their knowledge-making processes when engaging with GenAI.

2.3 AI Literacy and Epistemic Agency

In the context of GenAI-supported learning, AI literacy and epistemic agency can be understood as related but distinct dimensions of media competence. While AI literacy equips students with the cognitive, social, and ethical competences required to understand and critically evaluate GenAI outputs, epistemic agency refers to their capacity to intentionally direct, justify, and assume responsibility for their own epistemic actions when engaging with such tools. Following Barzilai and Chinn (2018), epistemic agency can be described as learners' deliberate capacity to regulate and steer their knowledge-building activities in the service of advancing understanding.

From an educational perspective, this concept can be further understood through the temporal lens proposed by Emirbayer and Mische (1998), who conceptualise agency as a temporally embedded process comprising iterative, projective and practical-evaluative dimensions. In the context of writing, these orientations become visible in how learners draw on existing knowledge practices (iterative), imagine and plan future lines of inquiry (projective), and make situated judgements in the present (practical-evaluative). Academic writing, in this sense, can be regarded as a temporal activity that continuously links past knowledge, present reasoning, and future-oriented projection. Writers reactivate disciplinary conventions, reuse established structures, and cite prior work – activities that exemplify the iterative orientation of agency. At the same time, they project their texts toward anticipated audiences and research purposes, envisioning what knowledge still needs to be developed or communicated – an expression of the projective dimension. Finally, they make evaluative decisions in the moment of writing: selecting arguments, weighing evidence, and formulating claims with contextual sensitivity – actions characteristic of the practical-evaluative mode. Understanding epistemic agency in this way provides the conceptual foundation for the analytical framework developed in this study by conceiving epistemic agency as the domain-specific expression of this competence, centred on learners' ability to take deliberate and reflective control over their knowledge-making processes when engaging with GenAI.

In higher-education contexts, this implies that students not only operate GenAI tools effectively but also reflect on when and how these tools should be used to support reasoning and argumentation. From a media-pedagogical perspective, this progression from AI literacy to epistemic agency builds on Baacke's (1996) understanding of media competence. Fostering epistemic agency in GenAI-supported writing therefore requires pedagogical designs that move students from functional tool competence toward reflective and epistemically responsible authorship.

2.4 Conceptual model and implications for media didactics

The preceding discussion has shown that scientific writing can be understood as an epistemic practice (2.1), that GenAI reshapes this practice in ways that challenge students' epistemic responsibility (2.2), and that AI literacy provides the foundation for fostering epistemic agency (2.3). Bringing these strands together, this section outlines a media-didactic model that links these concepts within the framework of Baacke's (1996) model.

Based on Baacke's model, the paper proposes a layered progression: Digital Literacy → AI Literacy → Epistemic Agency, all situated within the normative frame of Epistemic Integrity. Each level builds upon and transforms the previous one. Digital literacy provides operational and informational foundations; AI literacy extends these toward the understanding and critical use of algorithmic systems; and epistemic agency foregrounds learners' capacity to regulate and justify their knowledge-making activities. Epistemic integrity serves as the ethical compass that ensures these activities remain aligned with academic and civic responsibility.

Within Baacke's (1996) model, this progression specifies how media competence unfolds under GenAI-mediated conditions. Accordingly, the distinction introduced in section 2.1 between media-related tool use and epistemic collaboration maps onto Baacke's dimensions of instrumental media use (*Mediennutzung*) from reflective media critique (*Medienkritik*). Baacke's model underscores that epistemic agency must be exercised ethically and transparently. From a didactic standpoint, such a framework calls for learning designs that make epistemic decision-making visible, traceable, and discussable – conditions essential for cultivating reflective and responsible engagement with GenAI in higher education. In line with the design-based character of this study, the next chapter describes how the course served as a research environment for testing and refining this model through empirical observation and qualitative coding. It further details how epistemic agency was operationalised within this setting, adopting an exploratory approach to examine how it can be cultivated and empirically traced in practice.

3. Methodology

The present study is embedded in a design-based research (DBR) framework (Reinmann 2023; Anderson and Shattuck 2012) and forms part of the iterative redesign of the compulsory Scientific Writing course at the ZHAW School of Engineering (SoE). Data were collected during the second course iteration in spring term 2025. The course design and its development across iterations have been described in detail in the introduction and in Schnatz and Bieri (2024; 2025). This chapter outlines the research design, case selection, data, and analytical procedures used in the exploratory qualitative analysis.

3.1 Research design and rationale

Within this DBR setting, the present exploratory analysis focuses on a qualitative case study designed to examine GenAI-supported collaborative writing within a specific instructional context. The case study serves an illustrative rather than representative function, allowing for an in-depth analysis of writing practices within a bounded context. The collaborative group was defined as the analytical unit, reflecting the group-based organisation of the course assignment. One group was selected based on methodological criteria, as its prompting journal provided a substantive and detailed record of prompts, AI-generated outputs, and accompanying written comments across all defined writing phases. This level of documentation enabled a systematic reconstruction of the group's GenAI use throughout the writing process.

3.2 Case selection and data

The analysed case consists of a student group of four engineering students who collaboratively completed a scientific writing assignment during the second iteration of the Scientific Writing course in spring term 2025. The group worked collaboratively throughout the assignment, which was completed as part of the regular course requirements. The data analysed comprise multiple artefacts that document the writing process and its instructional context:

- (1) Prompting journal entries covering all writing phases (topic generation, drafting, revision), including prompts, GenAI outputs, and reflective comments (as shown in Table 1)

Tool	Goal	Prompt	Results & Reflection
Chat GPT	Narrow down the topic	Suggest ways to narrow down our topic	Which findings were helpful? Were there any challenges or uncertainties?

Tab. 1: Layout of prompting journal used in the course.

- (2) The student text (in German) that the group submitted as the final writing assignment

These artefacts provide complementary sources of information on students' use of GenAI and the resulting written outcome. All data were pseudonymised and processed in accordance with the ZHAW Code of Ethics in Research (ZHAW Zurich University of Applied Sciences, n. d.) and the Swiss Academies' Code of Conduct for Scientific Integrity (Aebi-Müller et al. 2021).

3.3 Analytical approach and coding

The exploratory analysis of the case study follows the principles of qualitative content analysis as outlined by Kuckartz and Rädiker (2024). This approach combines structured, rule-based procedures with interpretive depth, allowing for the systematic analysis of meaning patterns in text-based data. The coding process was designed to capture indicators of epistemic agency across the artefacts described in section 3.2, while remaining sensitive to the contextual and reflective dimensions of students' collaborative writing practices. Two exploratory coding schemes were developed deductively from the theoretical frameworks presented in sections 2.2–2.4, drawing on the key constructs of media competence (Baacke 1996) and epistemic agency (Barzilai and Chinn 2018; Chan 2025; Emirbayer and Mische 1998). Baacke's concept of media competence informed the analysis of the students' collaborations with GenAI tools as documented in their prompting journal, while the concept of epistemic agency guided the analysis of the final student text.

For the analysis of the prompting journal, Baacke's (1996) four dimensions of media competence – media critique, media knowledge, media use and media design – were applied to identify reflective and productive aspects of students' media engagement with GenAI, such as evaluating GenAI outputs (media critique) or using tools for specific purposes (media knowledge/ media use). Table 2 summarises the three analytical categories derived from Baacke's (1996) model, each representing an epistemic-agency dimension that integrates reflective (media critique, media knowledge) and productive (media use, media design) aspects of GenAI engagement. The category descriptions summarised in Table 2 specify the operationalisation of these dimensions for the coding process. Entries in the prompting journal could be assigned to multiple categories when they contained elements corresponding to more than one dimension.

Epistemic-agency dimension (empirical code)	Corresponding Baacke dimension(s)	Interpretation in GenAI-supported writing	Typical indicators / subcodes
Decision-making	<i>Media use:</i> strategic application <i>Media design:</i> productive adaptation	Students decide when, how, and why to use GenAI tools for specific writing purposes; demonstrate agency in integrating or rejecting outputs.	Uses-AI-strategically («for the introduction») Rejects-AI-output-for-quality («verworfen») Selects-tool-for-specific-task
Evaluation	<i>Media critique:</i> critical reflection <i>Media knowledge:</i> understanding system logic	Students critically assess GenAI outputs, identify inaccuracies, and justify acceptance or rejection based on epistemic criteria.	Evaluates-AI-output («useful / not useful») Identifies-AI-error («citation incorrect») Compares outputs across tools
Self-regulation	<i>Media critique:</i> reflection on process <i>Media design:</i> authorship and control	Students monitor their writing process, maintain authorship, and align GenAI support with personal learning goals or ethical standards.	Maintains-authorship («should sound like me») Adjusts-prompting-strategy Reflects on overreliance / transparency

Tab. 2: Exploratory coding scheme for the analysis of the prompting journal.

For the analysis of the student text, the concept of epistemic agency was refined through the temporal model of agency proposed by Emirbayer and Mische (1998). In this model, agency is conceptualised as a temporally embedded process comprising iterative, projective, and practical-evaluative orientations (see section 2.3). Translated into the domain of academic writing, these orientations informed the development of three corresponding epistemic dimensions – epistemic positioning, epistemic reasoning, and epistemic reflection and justification – which guided the interpretation of the student text. Table 3 presents the exploratory coding scheme and definitions of the analytical dimensions.

Dimension	Definition / Focus	Typical indicators
Epistemic Positioning	How writers frame problems, formulate research aims, and make procedural or methodological choices; reflects iterative and projective agency.	Contextualisation, problem statements, purpose definitions, methodological rationales.
Epistemic Reasoning	Analytical and comparative operations through which writers construct, evaluate, and justify knowledge claims; reflects practical-evaluative agency.	Concept definition /differentiation, source integration, evidence evaluation, causal explanation.
Epistemic Reflection & Justification	Meta-level reasoning that integrates past knowledge, present decisions, and future implications; includes ethical, methodological, and theoretical justification.	Limitation awareness, ethical reflection, boundary or scope justification, significance statements.

Tab. 3: Exploratory coding scheme for student text.

The two exploratory coding schemes are conceptually distinct but methodologically aligned: both were designed to trace indicators of epistemic agency – one through students’ collaboration with media (prompting journals) and the other through their textual enactment of epistemic functions (student text). During the iterative coding process, inductive refinement was applied to accommodate specific patterns emerging from the data, following Kuckartz and Rädiker’s (2024) stepwise model. The prompting journal and the final student text were coded manually in Excel. Coding was initially carried out independently by both authors, followed by collaborative discussion and negotiated agreement to resolve discrepancies. This approach ensured interpretive coherence and enhanced the transparency of the exploratory analysis.

4. Results

The selected group conducted a systematic literature review to develop a classification of dark patterns in e-commerce. This chapter presents the analysis of their prompting journal and student text.

4.1 Analysis of prompting journal

The prompting journal documented the group’s collaboration with GenAI tools across all writing phases and was analysed using the exploratory coding scheme presented in section 3.3, Table 2. The prompting journal comprises 33 entries distributed across the writing phases (Table 4), with most collaborations occurring during topic generation and literature research. The group employed a diverse set of GenAI tools, combining general-purpose LLMs (ChatGPT, Copilot, DeepSeek, ChatPDF) with specialised research assistants (Elicit, Consensus) to identify sources, refine research questions, and adjust

conceptual focus. This pattern indicates an emerging ability to align technological affordances with specific epistemic goals and to adapt tool choice strategically as writing progressed.

Writing phase	Entries	Dominant AI tools	Main purpose / epistemic focus
Topic generation	7	Chat GPT, Copilot	Idea exploration, framing research question
Literature research	19	Elicit, Consensus, DeepSeek	Source identification, paraphrasing, synthesis
Planning / structuring	2	ChatGPT	Outline creation, conceptual organisation
Writing	4	ChatGPT, DeepL Write	Drafting, wording refinement
Revision	3	ChatGPT, Grammarly	Stylistic editing, consistency check

Tab. 4: Overview of selected group's prompting journal entries by writing phases and tool usage (n=33).

4.1.1 Topic generation

During topic generation, the group used Copilot, Consensus, and Elicit to identify research areas and refine their research question. The entries show a shift toward evaluation-oriented epistemic agency: students assessed GenAI-suggested topics for relevance, novelty, and feasibility, explicitly rejecting unfitting suggestions. Using multiple tools in parallel (Copilot for brainstorming, Elicit for source-based exploration) illustrates strategic orchestration and selective integration of GenAI output. Reflections reveal awareness of GenAI limitations – marking suggestions as «useful» or «not relevant» – and a balance between curiosity and critical distance. Table 5 illustrates such decision-making and evaluation. Using the research assistant Consensus, the students tested whether sufficient studies existed on dark patterns in e-commerce.

Tool	Purpose	Prompt	Results and Reflection
Consensus	Determine whether there are sufficient studies on the topic	How did dark patterns in e-commerce evolve across time?	At first glance, many of the results appear to have nothing to do with the development of dark patterns in e-commerce. However, I was able to use one of the sources provided.
Comments: «many of the results ... nothing to do with...» → Evaluation (Evaluates-AI-relevance; Rejects-irrelevant-sources) «I was able to use one of the sources» → Decision-making (Selects-usable-source; Defines-final-topic)			

Tab. 5: Example for topic generation entry in prompting journal including authors' coding and comments.

The reflection in Table 5 reveals a twofold epistemic process. Students demonstrate evaluation by critically assessing GenAI-generated material – an act of epistemic vigilance aligned with media critique in Baacke’s (1996) model (see Section 3.3, Table 2). Simultaneously, they exhibit decision-making grounded in control and productive adaptation, corresponding to media design within the same framework.

4.1.2 Research phase

The research phase produced the largest number of entries ($n=19$), reflecting intensive GenAI-supported information retrieval and evaluation. The group combined Elicit, Web of Science, Consensus, Copilot, ChatPDF, and translation tools to iteratively refine their search and validate evidence. Queries were reformulated to improve precision; synonyms were generated and filtered for specificity; and GenAI-assisted PDF Q&A tools were used for screening, with manual verification maintained throughout. The entries reveal a process of conceptual boundary work – for instance, distinguishing «asshole design» from dark patterns and narrowing the scope to e-commerce. This led to the exclusion of irrelevant or mismatched sources. Indicators of epistemic integrity appear when students verified GenAI claims against primary texts, identified citation errors, and deleted fabricated information («statement deleted», «solution unclear»). In several cases, they cross-checked outputs across tools, practising epistemic triangulation and demonstrating awareness of each system’s affordances and constraints. Overall, this phase evidences decision-making, evaluation, and self-regulation (Table 2). These practices align with Baacke’s (1996) dimensions of media critique, media knowledge, and media use: students critically assessed GenAI outputs for accuracy and reliability (media critique), deepened their understanding of how GenAI systems operate and retrieve information (media knowledge), and strategically applied multiple tools to optimise their research process (media use). Through these intertwined competences, the group displayed a developing form of media design – the productive integration of GenAI into their scholarly workflow while maintaining epistemic control and accountability.

4.1.3 Drafting, writing and revision

Since the prompting journal entries for drafting, writing, and revision were often overlapped, the analysis addresses these phases collectively. The students employed ChatGPT for phrasing, Copilot for synthesis, and ChatPDF for feedback. Table 6 provides a representative example illustrating how these tools prompted reflection across all three epistemic-agency dimensions (Table 2).

Tool	Goal	Prompt	Results and Reflection
ChatPDF	receive feedback on methodology chapter	Check the «Methods/Procedure» section of the assignment you have been given to see whether the content fulfils the four criteria of «objectivity», «validity» «reliability» and «reproducibility». Please do not give me any suggestions for improvement. Instead, simply list the areas that need improvement. Thank you. These four criteria are defined as follows: An appropriate methodology ensures the objectivity, reliability, validity, and reproducibility of the research. Therefore, it is essential that the methodology is described in detail and transparently in the methodology chapter. • Objectivity: The degree to which research results are free from personal bias or influence from the researcher. Objective research ensures that findings are based solely on data and evidence, not on subjective opinions or expectations. • Validity: The degree to which a method accurately measures what it is intended to measure. A valid study ensures that the conclusions drawn truly reflect the phenomenon being investigated, without distortion or error. • Reliability: The extent to which a research method produces stable and consistent results over repeated trials or measurements. If the same study is conducted under similar conditions, reliable methods will yield similar outcomes each time. • Reproducibility: The ability of other researchers to repeat the study using the same methods and data, and achieve the same results. Reproducible research provides enough detail in its methods and data presentation to allow independent verification and confirmation of findings.	ChatPDF criticised the «Methods/Procedure» section in many places. Some of the points of criticism make sense to me, others less so. For example, ChatPDF believes that it is unclear why a source is selected. However, I noted in the text that the source must simply mention at least one dark pattern. The points of criticism that make sense to me have been implemented accordingly. However, in order for ChatPDF to recognise the requirements for this chapter, I had to insert the relevant theory from Moodle into the prompt.
Comments: «Some of the points of criticism make sense to me, others less so» → Evaluation (uses-AI-for quality evaluation) «However, I noted in the text that the source must simply mention at least one dark pattern» → Self-Regulation/Justification (maintains-authorial-control) «The points of criticism that make sense to me have been implemented accordingly» → Decision-making (selectively-applies-AI-suggestions) «However, in order for ChatPDF to recognise the requirements for this chapter, I had to insert the relevant theory from Moodle into the prompt» → Self-Regulation/Justification (is-in-control-of prompting-strategy/output-awareness)			

Tab. 6: Example for drafting and revision entry in prompting journal including authors' coding and comments.

This example in Table 6 demonstrates how evaluation, decision-making, and self-regulation / justification co-occur within a single GenAI collaboration. The students critically assessed GenAI feedback, accepted useful suggestions selectively, and rejected those inconsistent with their reasoning or disciplinary conventions. In other entries they further refined outputs to preserve coherence and personal voice («should sound like me»), showing increasing awareness of the tension between assistance and authorship. During the final revision, the group again relied on GenAI tools such as ChatGPT and DeepL to review, translate, and polish their text. Prompts from this phase display advanced self-regulation: students sought feedback on structure and clarity while maintaining critical oversight. They evaluated GenAI feedback explicitly, integrated helpful suggestions, and emphasised transparency in revisions («I used the translation directly. The only thing I changed...»). Across these later phases, the prompting journal illustrates a clear maturation of epistemic agency. Early collaborations with GenAI supported exploration and structural organisation, whereas later phases foregrounded evaluation, self-regulation, and epistemic integrity. The students enacted media critique through the critical assessment of GenAI feedback, media knowledge by understanding how GenAI interprets task instructions, media use through strategic tool orchestration, and media design by productively integrating GenAI outputs while retaining authorship. Rather than delegating epistemic work to GenAI, the group increasingly exercised reflective stewardship – treating the technology as a managed resource rather than a knowledge authority. Their developing competence thus bridges Baacke's (1996) dimensions of media critique and media design, uniting digital literacy with epistemic responsibility.

4.2 Analysis of student text

Building on these insights into reflective GenAI engagement, this section analyses the group's final paper to examine how epistemic decision-making and authorship become visible in the final product. Drawing on the concept of epistemic agency as operationalised in Table 3, the analysis traces three epistemic dimensions in the final student text.

The student text (≈4,000 characters) follows the conventional structure of an academic research article. The introduction frames the problem of manipulative design in e-commerce and formulates a focused research question; the theory section defines and classifies dark patterns; the methods describe database selection, search strings, and inclusion criteria for the systematic literature review; the results present derived categories with supporting tables; and the discussion synthesises findings, highlights ethical and regulatory implications, and outlines limitations and future research directions.

4.2.1 Epistemic positioning

The student text demonstrates clear epistemic positioning, particularly in the introduction and methods sections. The students situate their work within ethical and regulatory debates on manipulative design, formulate a focused research question, and justify methodological decisions such as limiting the corpus to eight sources. Explicit references to search procedures and data boundaries indicate procedural clarity and scope control – signs of epistemic awareness and authorship responsibility. To illustrate how these epistemic orientations manifest at the textual level, a representative passage from the introduction was colour-coded according to the analytical framework in Table 3 (see Figure 1).

1. Einleitung

Contextualisation

Der Umsatz im Online-Handel hat sich zwischen 2013 und 2023 mehr als verdoppelt (siehe Abbildung 1). Damit haben sich nicht nur die Konsumgewohnheiten verändert – auch der Einsatz manipulativer Designtricks, sogenannter Dark Patterns, hat zugenommen. Dabei handelt es sich um irreführende Designmethoden, die gezielt psychologische Mechanismen ausnutzen, um Menschen zu Handlungen zu verleiten, die nicht in ihrem besten Interesse liegen. Ihr Verhalten wird so beeinflusst, dass sie unbeabsichtigt Käufe tätigen, Abonnements abschliessen oder der Weitergabe persönlicher Daten zustimmen. Dark Patterns dienen in erster Linie der Maximierung wirtschaftlicher Interessen auf Seiten der Anbieter – oft auf Kosten der Konsument:innen, etwa durch erzeugten Zeitdruck, eingeschränkte Optionen oder das Verschleiern wichtiger Informationen. Auf diese Weise verstärken sie die bestehende Machtasymmetrie zwischen Plattformen und Nutzer:innen und werfen zugleich dringliche ethische und regulatorische Fragen auf. [1]

- states problem

- paraphrasing external knowledge

ethical reflection

critical interpretation

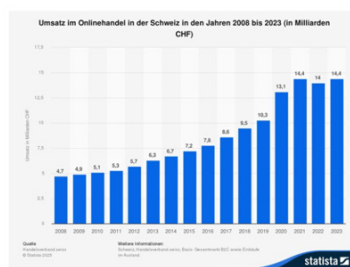


Abbildung 1 Umsatzwachstum im Onlinehandel von 2008 bis 2023 in der Schweiz von <https://de.statista.com/statistik/daten/studie/186733/umfrage/schweiz-umsatz-im-online-und-versandhandel-b2c-zeitreihe>

Rechtliche und ethische Diskussionen hinterfragen, ob bestehende Verbraucherschutzgesetze für digitale Manipulation ausreichen. Unter EU Regulationen ist nicht definiert, wie mit Dark Patterns umzugehen ist. [2]

Move 2

- ethical & legal reflection

identification of gap

Ziel dieser Arbeit ist es, eine Sammlung von Studien zu analysieren, um so einen Überblick über Dark Patterns zu schaffen. Die zentrale Fragestellung lautet, «Wie lassen sich Dark Patterns auf Grundlage bestehender Literatur systematisch klassifizieren, und welche Implikationen ergeben sich daraus für Forschung und Designpraxis?». Zur Beantwortung wird eine systematische Literaturanalyse mithilfe der Datenbank Scopus durchgeführt.

purpose statement

RQ formulation

- methodological justification

Move 3 The aim of the work is clearly formulated. RQ is available. Methodology is briefly outlined.

Figure 1: Example of coded student text (introduction); blue=epistemic positioning, yellow=epistemic reasoning, green=epistemic reflection and justification.

As Figure 1 illustrates, the students' introduction exhibits a clear rhetorical and epistemic structure shaped by prior instruction according to the CaRS model, which had been introduced in the self-study units of the course. The structured organisation of context, gap, and purpose suggests that students actively applied this model – supported by GenAI-assisted feedback – to strengthen coherence and argumentative flow.

4.2.2 Epistemic reasoning

Reasoning processes are most evident in the results section, where the students synthesise and compare classifications of dark patterns from existing studies. They employ comparative and analytical reasoning to evaluate overlaps, refine definitions, and integrate evidence across sources. This evaluative synthesis goes beyond summarisation, reflecting a developing ability to interpret and justify conceptual distinctions – an expression of practical-evaluative agency in Emirbayer and Mische's (1998) sense.

4.2.3 Epistemic reflection and justification

Reflective reasoning appears most clearly in the discussion, where the students connect their findings to broader ethical and societal implications such as consumer trust and regulatory responsibility. They acknowledge methodological limitations (restricted corpus, reliance on secondary sources) and propose directions for further research. These meta-level reflections indicate emerging critical awareness, even if theoretical integration remains partial.

Across the text, the group exhibits developing epistemic agency by balancing methodological clarity, evaluative reasoning, and ethical reflection. The final text thus externalises the reflective, deliberate engagement with GenAI observed in the prompting journal – illustrating how epistemic responsibility and AI literacy converge in GenAI-supported academic writing.

5. Discussion and Outlook

This exploratory case study examined how instructional design can scaffold epistemic agency in GenAI-mediated writing tasks and how such agency becomes visible in students' writing processes and products. Two research questions guided the analysis:

- (1) How can instructional design scaffold epistemic agency in GenAI-mediated writing tasks?
- (2) Which indicators of epistemic agency emerge in students' prompting journals and final texts?

The analysis of the prompting journal indicated that the student group engaged with GenAI tools in a reflective manner that foregrounded questions of authorship and responsibility. Across the writing phases, they demonstrated decision-making, evaluation, and

self-regulation that align with Baacke's dimensions of media use, media critique, and media design. Students strategically selected GenAI tools for different purposes, cross-checked AI-generated information, verified sources, and reflected explicitly on authorship and transparency. Within this case, these practices can be interpreted as indicators of developing media competence and epistemic responsibility.

The analysis of the students' final text showed complementary patterns. The student text exhibited epistemic positioning through the formulation of the research problem, the clarification of methodological scope, and the articulation of procedural transparency, as well as epistemic reasoning through evaluative synthesis and conceptual differentiation. Instances of epistemic reflection and justification appeared in the discussion section, where the students addressed limitations, ethical implications, and avenues for future research. Within this case, epistemic agency became visible in the text through structured reasoning and reflective awareness, rather than through a mere reproduction of GenAI-generated material.

Comparing both analyses highlights a continuity between process and product, alongside shifts in visibility and explicitness. In the prompting journal, epistemic agency is articulated overtly: students specify evaluative criteria, deliberate on GenAI affordances, and justify methodological decisions. In the final text, epistemic agency appears more implicitly, embedded in formal features such as methodological transparency, argumentation, and reflective commentary.

This pattern suggests that instructional scaffolds such as prompting journals, iterative reflection, and explicit discussion of GenAI tool use can make epistemic processes visible that would otherwise remain tacit. Within this case, the course design appears to have supported students' metacognitive engagement with GenAI use and their attention to questions of authorship and responsibility. These findings resonate with Baacke's (1996) understanding of media competence as reflective *Handlungskompetenz*. In this sense, the students' practices of evaluating, adapting, and justifying GenAI outputs can be interpreted as instances of such reflective action.

Their selective integration of GenAI-generated information illustrates, within this case, a movement from functional tool use toward epistemically grounded authorship, in which information is critically evaluated and transformed into justified knowledge claims. Viewed through Emirbayer and Mische's (1998) temporal lens, the findings further suggest that instructional scaffolds can support the coordination of iterative, projective, and practical-evaluative orientations. The prompting journal foregrounded engagement with prior knowledge (iterative), the exploration of inquiry directions (projective), and situated evaluative decisions (practical-evaluative), while the final text reflects these orientations in rhetorical and methodological choices. Together, these artefacts show how epistemic agency can be scaffolded and traced empirically in GenAI-mediated writing.

While the findings provide insights into how epistemic agency can become visible in GenAI-mediated writing, they must be interpreted with caution given the exploratory case study design. The study is based on one student group within a specific instructional setting. Moreover, the analyses rely exclusively on written artefacts (prompting journal and final text) without triangulation from interviews or observations that could capture real-time reasoning, collaboration, or affective factors.

In addition, both coding schemes were developed exploratively. Although grounded deductively in established theoretical frameworks, they were refined inductively through engagement with the data. While analytically productive in this context, the categories require further testing, validation, and potential adaptation across additional cases.

Future research will therefore extend the dataset and refine the methodological approach. The next phase of the project includes the analysis of students' draft versions to reconstruct in greater detail how GenAI-generated output documented in prompting journals is integrated into developing and final texts. In addition, planned recordings of coaching sessions with future cohorts will enable the capture of cognitive and ethical reasoning in real time, offering deeper insight into students' evolving epistemic practices.

Despite these limitations, the findings offer implications for the design of writing instruction in GenAI-mediated learning environments. Scaffolds that make epistemic processes visible, for example through reflective documentation, peer dialogue, and transparent tool use, may support students in engaging with GenAI in more deliberate and reflective ways. Integrating structured reflection tasks into course design can encourage students to position GenAI as a resource to be managed rather than as a source of epistemic authority. In this sense, AI literacy emerges not as an end in itself, but as a foundational condition for responsible engagement with knowledge technologies.

In this context, the findings also invite a more differentiated understanding of AI literacy. Rather than conceptualising AI literacy primarily as the ability to operate AI tools effectively or to comply with institutional guidelines, the case suggests that AI literacy becomes educationally meaningful when it is oriented toward epistemic judgment. The students' practices indicate that knowing *how* to use GenAI systems is insufficient on its own; what matters is the capacity to evaluate GenAI-generated output, to recognise its limitations, and to decide when and how such output can be integrated into one's own reasoning.

From this perspective, AI literacy functions as a mediating competence between digital tool use and epistemic agency. It enables learners to engage with GenAI systems critically and reflectively, but does not itself guarantee epistemic agency. Epistemic agency only becomes visible when AI literacy is embedded within instructional designs that foreground justification, reflection, and authorial responsibility. Accordingly, the findings suggest that AI literacy should be understood not as an endpoint of instruction, but as a necessary condition that must be pedagogically extended toward epistemic agency.

From the perspective of instructional design, the findings underscore the importance of designing writing tasks that externalize epistemic processes rather than treating writing solely as a product-oriented outcome. The case suggests that epistemic agency does not emerge automatically from GenAI availability but depends on deliberate pedagogical scaffolds that structure when, how, and for what purposes GenAI may be used. In this study, the prompting journal functioned as such a scaffold by making epistemic decisions explicit, traceable, and discussable across writing phases. This indicates that instructional design for GenAI-supported writing should prioritise artefacts and routines that require students to articulate evaluative criteria, justify tool use, and reflect on authorial responsibility.

For writing pedagogy, the findings reinforce the view of academic writing as an epistemic practice rather than a primarily linguistic or formal skill. The students' texts demonstrate that epistemic agency becomes visible not through stylistic polish but through problem framing, methodological justification, evaluative synthesis, and reflective limitation awareness. These are dimensions that traditional writing instruction often presupposes but rarely makes explicit. GenAI intensifies this challenge by enabling surface-level textual competence without corresponding epistemic engagement. The case therefore supports a pedagogical shift toward explicit instruction in epistemic functions of writing, such as positioning, reasoning, and justification, and toward learning designs that align GenAI use with these functions rather than allowing it to substitute them.

This shift has implications not only for instruction but also for assessment. If epistemic agency is expressed through justificatory reasoning, methodological transparency, and reflective judgement, then assessment practices that prioritise textual fluency or formal correctness risk overlooking the very dimensions that GenAI most directly affects. The findings therefore suggest the need to reconsider how writing performance is evaluated in GenAI-mediated contexts, with greater emphasis on epistemic criteria that cannot be outsourced to automated systems.

Taken together, the findings suggest that effective GenAI-integrated writing pedagogy requires a reorientation of instructional design: from supporting text production to scaffolding epistemic action. Writing instruction must therefore foreground epistemic responsibility as a learning objective in its own right and treat GenAI as a didactic resource whose use is shaped by pedagogical intent rather than technical convenience.

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