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Exemplifying methodological triangulation in GenAI-supported writing research

A course-based study

1 Introduction

The integration of generative AI (GenAI) into academic writing (Dunnigan et al., 2025; Helm & Hesse, 2024; Kelly et al., 2023; Rapp et al., 2025) is reshaping not only how texts are produced but also how knowledge is constructed and evaluated. This poses profound didactic and epistemic challenges (Anson et al., 2025). Research on writing studies is increasingly conceptualizing scientific writing as an epistemic and genre-based practice situated in disciplinary conventions (Chen, 2019; Kruse, 2013; Pohl, 2007, 2016). In GenAI-supported contexts, these epistemic and metacognitive processes partially become distributed across human and machine agents. Recent work shows that GenAI can boost task performance while weakening metacognitive accuracy (Fernandes et al., 2026), thereby raising new questions about how writers maintain epistemic agency when goal setting, evaluation, and reasoning are shared with AI systems. Alvarado (2023) conceptualizes GenAI systems as “epistemic technologies”—tools that shape how meaning is constructed through reasoning and explanation. Their use in education therefore redefines what it means to “know” or “learn” through writing. Similarly, Parker et al. (2024) identify GenAI-supported writing as a hybrid form of collaboration involving dynamic brainstorming, negotiation of meaning, and comparative evaluation. These interactions unfold across prompts, drafts, and feedback cycles, yet often leave no visible trace in the final product. This invisibility complicates both instruction and research, because textual analysis alone cannot reveal how epistemic decisions are made. Studying writing with GenAI thus requires triangulated methods that capture both written outcomes—the product—and the processes of negotiation, decision making, and revision. This article adopts a method-focused lens, exploring triangulation (Flick, 2023) as a strategy to enhance epistemic transparency in GenAI-supported writing. We first outline key methodological challenges, then present triangulation strategies that address these issues. Drawing on our own iterative course-based study (Schnatz & Bieri, 2024, 2025), we illustrate how student texts, prompting journals, and additional data can be combined to trace how epistemic agency is enacted across writing phases.

Didaktik Deutsch

Halbjahresschrift für die Didaktik der deutschen Sprache und Literatur

Special Issue (2026) – Writing with AI. S. 158–165

DOI: 10.21248/dideu.974

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2 Current methodological challenges

Since the release of accessible large language models (LLMs), a growing body of research has documented tool use and student behavior (e.g., Cieliebak et al., 2023; Helm & Hesse, 2024; Rapp et al., 2025). These studies offer valuable descriptive insights, yet often stop short of examining how GenAI use affects the quality, structure, or epistemic depths of writing. Evidence for deeper rhetorical or structural development, particularly in non-EFL contexts,¹ remains limited. Pedagogical integration has likewise received only partial attention. Although Kelly et al. (2023) emphasize the need for GenAI tool literacy, curriculum integration, and assessment redesign, most studies stop at offering recommendations rather than going on to engage in empirical analyses of classroom practice. Process-oriented studies do exist (e.g., Cummings et al., 2024), but they remain isolated and methodologically constrained. Taken together, current research leaves several methodological gaps. These can be summarized as three interrelated challenges: ethical concerns and originality, balancing AI and human insight, and assessment difficulties (see Table 1).

Table 1

Methodological Challenges in GenAI-Assisted Writing Research

Challenge	Description
Ethical concerns + originality	Blurred boundary between student- and AI-generated content complicates authorship, originality, and academic integrity. Reliable capture of distributed agency is difficult without breaching ethical norms.
Balancing AI + human insight	Risk that overreliance on GenAI may reduce opportunities for critical thinking and rhetorical development. Invisible cognitive processes make negotiation of agency hard to trace.
Assessment difficulties	Traditional competence measures fail: Grammar/style gains may stem from tool affordances rather than student ability, thereby complicating fair evaluation.

Addressing these intertwined challenges requires robust triangulated process-focused research designs that can (a) trace how students use GenAI tools during writing; (b) link such use to measurable dimensions of text quality; and (c) situate these analyses within defined teaching contexts by combining textual analysis with data on tool interaction, student reflection, and instructional framing. This article therefore proposes a triangulated approach to researching GenAI-assisted writing. Triangulation refers to the systematic use of multiple methods and/or data sources to investigate one and the same phenomenon. In our project, we apply both data triangulation (integrating student texts, prompting journals, and survey responses) and methodological triangulation (combining text analysis, surveys, QDA, and QCA).

¹ When textual outcomes are assessed, the focus lies predominantly on English as a Foreign Language (EFL) settings (e.g., Song & Song, 2023; Tsai, Lin & Brown, 2024; Tseng & Lin, 2024).

3 Methods: Course context, data, and triangulated design

This study takes a mixed-methods approach within a design-based research (DBR) (Reinmann, 2023) framework, aiming (a) to examine how GenAI shapes writing processes and outcomes (see Schnatz & Bieri, 2024, 2025), and (b) to iteratively refine didactic strategies for GenAI-integrated writing instruction.² To address the methodological challenges mentioned in Table 1, triangulation was applied at two levels and is displayed in detail in the following Tables 2 and 3.

Table 2

Triangulated Data Sources

Source	Scope	Purpose
Student texts (in German)	Approx. 150 per iteration (2023–2025)	Compare rhetorical quality across Pre-/Post-GenAI cohorts
Prompting journals	Approx. 150 per iteration (2025)	Document tool use, reflection, epistemic decision making
Midterm surveys	$n = 22$ (2024), $n = 24$ (2025)	Capture perceptions of course design and GenAI literacy
Planned (Iteration 3, 2026)	Approx. 10 student texts + approx. 10 journals + pre/post surveys Recordings of coaching sessions	Enrich triangulation with coaching session recordings and longitudinal perception data

To support methodological transparency, several data sources were combined to capture both product- and process-related dimensions of GenAI-supported writing. Entries in the prompting journals frequently documented conceptual evaluations such as noting that suggested terms were “too specific” or that a proposed broader label was “actually a synonym.” Such process notes provided evidence of how writers assessed and refined AI-generated terminology during drafting.

Planned analyses combine (a) comparative text analysis of Pre-/Post-GenAI cohorts, (b) thematic and content analysis of prompting journals, (c) focused case studies of 10 projects, and (d) quantitative + qualitative survey evaluation. This design enables triangulation of product quality, process documentation, and student perceptions within a structured didactic setting. After data collection, the project

² The study was conducted in a second-semester scientific writing course at the Zürcher Hochschule für Angewandte Wissenschaften (ZHAW) with approximately 600 engineering students per term. Students write a scientific paper in German in groups of 3–4 students. Across two iterations (2024, 2025), GenAI tools are integrated into each lesson along the phases of writing (e.g., topic selection, drafting, and revision). The 2025 iteration added prompting journals and self-study units (video inputs, tutorials, genre-based exercises such as Swales’ [2014] CaRS model for introductions and Weissberg & Buker [1990] for discussions). The course design fosters procedural competence and epistemic awareness, while also contributing—indirectly—to students’ epistemic agency in hybrid human–AI writing contexts (see Barzilai & Chinn, 2018; Schnatz & Bieri, 2025).

aims to use the following methods detailed in Table 3 to address the methodological challenges described in the previous section.

Table 3

Triangulated Methods

Approach	Data	Focus
Comparative text analysis	Approx. 150 student texts (in German) per iteration (2023–2025)	Assess structural quality (e.g., CaRS-based intros), framing clarity, rhetorical coherence; later corpus-linguistic analysis of lexical/syntactic patterns
Thematic and content analysis	Approx. 150 prompting journals (2025)	Trace epistemic decision making/agency (goal setting, revision, tool evaluation) via QDA + QCA
Survey analysis	Midterm surveys (2024 $n = 22$, 2025 $n = 24$)	Perform a quantitative comparison of closed items; qualitative coding of open responses to assess course design and tool use
Planned (Iteration 3, 2026)	Coaching recordings, pre/post surveys, smaller cohort (approx. 40)	Trace epistemic agency through real-time instructor–student dialogue and longitudinal perception shifts

This design allows us to investigate GenAI’s impact on student writing at multiple levels: outcome quality, process transparency, and pedagogical integration. By combining student texts, prompting journals, surveys, and focused case studies, we can reconstruct how epistemic agency is enacted or compromised across writing phases. Triangulation both strengthens empirical validity and provides a methodological basis for refining instructional strategies that promote epistemic integrity in GenAI-supported academic writing.

4 Methodological insights from a triangulated approach

The triangulated design offers a promising foundation for researching GenAI-assisted writing by uncovering dimensions of writing that single methods overlook. The preliminary study of prompting journals along with initial thematic coding and the evaluation of the midterm surveys illustrate both the strengths of triangulation and the general challenges that remain. Prompting journals make visible how students interact with GenAI during different phases of writing (see, e.g., Table 4). They show pathways for linking GenAI use to rhetorical development and decision making. Mapping prompts across writing phases appears particularly useful for reconstructing trajectories of goal setting and revision.

Table 4

Illustration of Prompting Journal Entry (Example From a Student Group) Reflecting on the Use of ChatGPT for Literature Research

AI Tool	Goal	Prompt ³	Results and Reflection
ChatGPT	Literature research for theoretical foundations chapter	Find me current sources on the topic of metal 3D printing and conventional manufacturing. Find sources that describe the economic efficiency of the manufacturing processes.	Provides few good sources, very often confuses metal 3D printing with normal plastic 3D printing.

Whereas the prompting-journal entry above captures students' moment-to-moment reflections on their interaction with GenAI, the written products themselves provide a different lens on how epistemic decisions are enacted. The following excerpt (Figure 1 and Table 5) demonstrates how these textual traces were coded along our three epistemic categories.

Figure 1

Illustration of Initial Coding in Student Text

5.4. Ausblick für zukünftige Forschung

Um die Verbreitung und Wirkung einzelner Dark Patterns im Nutzungskontext fundiert zu analysieren, sind quantitative Studien notwendig. Methoden wie Click-Tracking oder Eye-Tracking können dabei helfen, die tatsächliche Aufmerksamkeit der Nutzer:innen zu erfassen und Rückschlüsse auf die Effektivität manipulativer Designs zu ziehen.

future research suggestions

methodological justification

Darüber hinaus sind Längsschnittstudien erforderlich, um die langfristigen Auswirkungen solcher Gestaltungsmuster auf Vertrauen, Nutzerbindung und Wiederkaufsabsicht

longitudinal design recommendation

zu untersuchen. Nur durch die Beobachtung über einen längeren Zeitraum lassen sich verlässliche Aussagen über mögliche negative Konsequenzen treffen.

reasoning

Da anzunehmen ist, dass Dark Patterns auf verschiedenen Plattformen unterschiedlich wirken – etwa in sozialen Netzwerken, Smartphone-Apps – erscheint eine plattformübergreifende Analyse sinnvoll. Solche Vergleiche könnten nicht nur differenzierte Einblicke in die Wirkmechanismen geben, sondern auch die Grundlage für gezielte regulatorische Massnahmen schaffen.

contextual differentiation

policy linkage

Gleichzeitig sollte die Forschung zu sogenannten „Bright Patterns“ und effektiven Digital Nudges intensiviert werden. Sie bieten ethisch vertretbare Alternativen zum manipulativen Design und zeigen, dass digitale Gestaltung auch im Sinne der Nutzer:innen möglich ist – etwa durch Transparenz, Nutzerautonomie und förderliches Entscheidungsverhalten.

ethical re-orientation/ outlook

positive vision

³ Originally written in German; prompt and reflection translated by the authors.

Table 5*Initial Coding Scheme of Epistemic Agency Traceable in the Student Text*

„Um die Verbreitung und Wirkung ... fundiert zu analysieren, sind quantitative Studien notwendig.“	Decision-making – Future research design suggestion	Proposes methodological next step; procedural foresight.
„Methoden wie Click-Tracking oder Eye-Tracking ...“	Evaluation – Methodological justification / instrument relevance	Evaluates suitability of specific tools for analyzing cognitive attention.
„Darüber hinaus sind Längsschnittstudien erforderlich ...“	Decision-making – Longitudinal design recommendation	Outlines temporal extension; structural proposal.
„Nur durch die Beobachtung ... lassen sich verlässliche Aussagen treffen.“	Reflection – Epistemic reasoning / validity reflection	Argues for longitudinal validity; metacognitive awareness of research logic.
„Da anzunehmen ist, dass Dark Patterns auf verschiedenen Plattformen unterschiedlich wirken ...“	Evaluation – Contextual differentiation / comparative reasoning	Analyzes variation potential; evaluative generalisation.
„Solche Vergleiche könnten ... Grundlage für gezielte regulatorische Massnahmen schaffen.“	Reflection & Justification – Societal implication / policy linkage	Reflects on regulatory utility; normative extrapolation.
„Gleichzeitig sollte die Forschung zu ‚Bright Patterns‘ ... intensiviert werden.“	Reflection & Justification – Ethical re-orientation / constructive outlook	Advocates value-oriented research agenda; transformative epistemic stance.
„Sie bieten ethisch vertretbare Alternativen ... Transparenz, Nutzerautonomie ...“	Reflection – Positive vision / normative synthesis	Concludes with constructive ethical synthesis; high-level reflective agency.

Note: blue = decision making, yellow = evaluation, green = self-regulation and reflection.

However, triangulation does not fully resolve key methodological difficulties. Ethical ambiguities remain around authorship, transparency, and the extent of student consent when journals expose cognitive processes. Interpreting GenAI's influence continues to be tricky: Even with prompts and outputs available, the rationale for why students accepted, modified, or ignored suggestions is not always recoverable. Although prompting journals improved epistemic visibility, they introduced issues of standardization: Students varied in how thoroughly and reflectively they documented their interactions. Finally, triangulated designs are resource-intensive, requiring significant time for data collection, coding, and integration across sources.

5 Discussion

The analyses are expected to contribute to both writing research and instructional design in GenAI-supported academic contexts. Linking prompting journals, writing-phase mapping, and text features also allows for the design of a transferable course model focusing on teaching writing with GenAI, while supporting and tracing the unfolding of epistemic agency during writing. A second contribution lies in conceptualizing prompting literacy as both a didactic and measurable competence. Prompts reflect epistemic behavior—how students frame questions, assess feedback, and revise accordingly. These practices can be scaffolded through teaching and serve as indicators of reflective engagement. Prompting literacy thus emerges as a key component of academic AI literacy. The triangulated design also enhances reproducibility and international transferability. Embedding a triangulated design in a structured writing curriculum and developing transferable materials aligns with open educational practices and current demands for didactic transparency. Finally, the study addresses a broader pedagogical challenge: how to preserve epistemic agency and integrity in technology-enhanced learning environments. Because of the phenomenon's inherent complexity, a triangulated approach can provide the depth and balance needed to address it in a meaningful way.

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