

(HOW) CAN ARTIFICIAL INTELLIGENCE ENHANCE FORMATIVE FEEDBACK IN HIGHER EDUCATION?

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Abstract

Formative and summative feedback are both essential components of the educational process, each serving distinct purposes. While summative feedback provides a retrospective evaluation of student performance – typically in the form of grades or scores – formative feedback can play a crucial role in supporting ongoing learning by offering timely, specific, and actionable guidance. It can help students identify knowledge gaps, adjust their learning strategies, and progress toward their academic goals. However, particularly in higher education, the demand for individualised and constructive formative feedback often exceeds the time and resources available to educators. This contribution explores the potential of artificial intelligence (AI) to support formative feedback processes in higher education. Specifically, we examine whether AI-generated feedback can enhance learning outcomes and foster student engagement, and under which conditions AI-based tools are capable of delivering detailed, criteria-oriented feedback on written assignments – thus supporting iterative learning and revision. Our analysis draws on recent case studies from educators who have implemented AI-supported feedback in their teaching, as well as on our own experiences, observations, and reflections. We explore both the affordances and limitations of current tools, with particular attention to issues of trust, transparency, and pedagogical value. While AI has the potential to streamline routine feedback tasks and reduce administrative workload, we emphasise the continued importance of human oversight to ensure quality, relevance, and alignment with learning objectives. Therefore, educators must develop specific AI competences to adapt and contextualise these tools effectively within their teaching practices. We also reflect on how students perceive and respond to AI-generated feedback, and whether they regard it as credible, useful, and supportive of their learning. In addition, we consider the integration of AI in digital assessment platforms such as Moodle, where it can be used to provide immediate, targeted feedback on closed-format tasks. We conclude that, when thoughtfully implemented and combined with human expertise, AI tools can enhance formative feedback practices in higher education, increase feedback efficiency, and contribute to more responsive and student-centred learning environments. This contribution adds to the emerging discourse on AI-supported feedback in higher education – an area full of potential yet still in its early stage.

Keywords: Artificial Intelligence (AI), formative feedback, higher education, student engagement, personalised learning

1 THE IMPORTANCE OF FORMATIVE ASSESSMENT IN UNIVERSITY TEACHING

Assessment can have a distinctive impact on students' learning [1]. It influences students' approaches to learning, their management of study time, and the quality of interaction both among peers and between students and instructors. It thus plays a central role not only in measuring achievement but also in shaping learning behaviours. [2]

A distinction is drawn between formative and summative feedback. Rather than providing a retrospective summary of student performance, formative feedback focuses on the learner's current level of understanding and progress. Its purpose is not to evaluate students, but to inform them about their present learning status, the intended learning outcomes, and the possible pathways to achieve these outcomes. Research has shown that student performance can be significantly enhanced when educators provide constructive support in the form of formative feedback. [3] Specific, task-related feedback can support learners in developing effective action strategies [4].

Yet in practice, the demand for individualised feedback often exceeds the time and resources available to lecturers, leaving students with limited opportunities to engage meaningfully with their learning process [4]. Recent initiatives have begun exploring whether artificial intelligence (AI) can help address this gap.

2 AI FEEDBACK

Findings on whether chatbots have an inherently positive effect on learning motivation remain inconclusive. While Wollny et al. (2021) and Ait Baha et al. (2023) report positive influences [5, 6], Brünner and Ebner (2025) were unable to confirm such effects [7]. Labadze et al. (2023) also highlight controversial and mixed results within the literature [8]. Nevertheless, it can be assumed that well-structured tools may have a positive impact on learning motivation, as Pölert points out in his tutorial video [9].

AI can automate or semi-automate parts of the feedback cycle – for example, analysing text drafts against given criteria, pointing out strengths and weaknesses, and suggesting improvements. Tools like *Fobizz* or *FelloFish* allow lecturers to provide prompts and criteria in advance, ensuring that feedback aligns with course objectives. This shifts the instructor's role from sole feedback provider to facilitator, guiding students in critically reflecting on AI-generated suggestions and integrating them into their revisions.

2.1 Advantages of AI systems for feedback

The use of AI for formative feedback can reduce the workload of educators and free up valuable time resources that may instead be devoted to individualised learner support [10]. AI-driven feedback can be generated at any time [11], and AI is capable of processing large volumes of data with high speed [12]. Feedback from learners suggests that AI-generated feedback is perceived as “objective and non-offensive” [10]. Moreover, students and educators have the opportunity to view and compare different versions of a text, allowing them to track the students' progress.

A key prerequisite for the successful application of AI-supported feedback is the learners' willingness to engage with it, to work on their own skills, and not to rely exclusively on external responses for their thinking processes [11]. Initial experiences from educators further indicate that learners generally respond positively to AI-based feedback tools [9].

2.2 Challenges of AI systems for feedback

The introduction of AI-supported feedback requires careful planning and will inevitably affect the design of teaching practices. Appropriate teaching and learning arrangements must be developed in which AI-based feedback can be used effectively. Students are also likely to perceive and respond to AI-generated feedback differently than they would to feedback provided directly by educators. [11]

For reasons of data protection, it is recommended that student texts should not be entered directly into AI tools by instructors. Instead, students themselves should be given the opportunity to upload their texts into an appropriate tool and thereby receive feedback. For practical implementation, instructors require a computer with internet access and access to suitable AI tools such as *ChatGPT*, *Academic AI*, *Fobizz*, or comparable platforms. Ideally, instructors register with the respective platform and then

provide students with a direct access link. This approach avoids the need for students to create their own accounts. An even more secure option is for the institution to provide a data protection-compliant device through which students can access the tools. [13]

The use of commercially developed systems is inherently associated with risks, as the underlying algorithms are not transparent [11]. Like all AI systems, AI-based feedback tools are not infallible. Moreover, such feedback systems often have access only to the information supplied by the instructor; external fact-checking does not take place. Consequently, AI cannot provide substantive corrections or assessments that go beyond the materials made available. At the same time, educators must ensure that only materials that meet data protection requirements are uploaded. [14]

Consistency is another challenge: identical inputs may yield different outputs, especially when the feedback criteria are imprecise or overly broad. Furthermore, at the time this contribution was created, such tools were neither able to reliably detect whether a text had been authored by AI, nor capable of identifying plagiarism. [14]

Overall, these tools can effectively support the writing and revision process, but they cannot replace the critical evaluation and pedagogical contextualisation provided by educators.

2.3 Pedagogical preconditions

Before text-generating AI tools are introduced into teaching and learning contexts, it is essential that educators familiarise themselves with the pedagogical opportunities and limitations of this technology. This includes carefully considering at which stages of the learning process and for which types of tasks the use of AI is both meaningful and didactically appropriate. In addition, instructors should explore suitable tools and platforms in order to make informed decisions, taking into account factors such as data protection, usability, and cost. [14]

For AI to provide helpful and context-sensitive feedback, it must first be supplied with the relevant task description and assessment criteria. This requires clear instructions that specify both the task framework and the expectations for the feedback.

Nevertheless, AI-generated responses should never be adopted uncritically. A central component of the learning process lies in subjecting the feedback to critical reflection – ideally in collaboration with students. Such reflection not only enhances the quality of the automated feedback but also strengthens learners' judgment and media literacy. [13]

Formative feedback should never be fully delegated to AI; rather, it should create space for additional individual guidance and reflection. As Winter (2024) emphasises, feedback is not a unidirectional process that can be outsourced to AI. It is crucial for educators to examine the feedback provided by AI to students and to reflect on how this feedback shapes their learning processes. [11]

2.4 AI-enhanced formative feedback approaches

2.4.1 Formative feedback through text-generating AI tools

Educators can create an AI assistant (e.g. in *Fobizz*, based on *ChatGPT*) that provides feedback to students or engages them in dialogue. The AI can be prompted, for instance, to analyse student texts according to predefined criteria, generate a feedback report that highlights strengths and weaknesses, and offer personalised learning suggestions – such as concrete recommendations for improving the text or targeted advice for further practice. Programming such an assistant requires knowledge of prompt design, as well as hands-on testing by the instructor. Students can access the assistant via a link or QR code without creating an account, while the instructor retains the ability to monitor student-AI interactions. [13]

Feedback generated by a self-programmed assistant can also be applied to other learning activities, for example in the form of a Socratic dialogue or through AI-generated Moodle tests. In this case, the instructor employs a generative AI system (e.g., CustomGPT or ChatGPT) to automatically produce questions and tailored feedback for a Moodle quiz. The AI can be prompted to not only create the multiple-choice questions themselves but also to generate individualised feedback for each response option. This feedback is displayed directly in Moodle when students answer the questions, providing precise explanations of why an answer is correct or incorrect, as well as guidance on which content should be reviewed further. Without AI, it would hardly be feasible for instructors to write differentiated feedback for every single response option within the available time. The automated process thus

significantly reduces instructors' workload and enables the integration of regular formative assessments with detailed feedback into teaching practice.

2.4.2 Formative feedback through tutoring systems

Tutoring systems such as *Fobizz* or *FelloFish* can be used to analyse student texts according to predefined criteria and to provide feedback or personalised learning suggestions. For this purpose, instructors input the task into the tool, along with precisely defined (and, where applicable, weighted) criteria and any relevant materials permitted for task completion. The task and its associated feedback can then be tested by the instructor and adjusted if necessary. Students subsequently receive access to the task via a link. [13]

Most tutoring systems are able to provide students with feedback on their initial submission and then compare this with a revised version of the same task. The AI-generated feedback typically includes criterion-based evaluation as well as suggestions for improvement. While such tutoring systems are primarily designed for use in schools, they may also be applied in higher education, depending on the subject area and the nature of the assignments.

3 METHODOLOGY

To explore how lecturers can use AI tools for formative feedback and how students perceive their use, we conducted a small pilot study in one of our university courses. The course, "General English," covers a range of topics, from presentations to describing graphs and trends. It is part of the Bachelor's Degree Programme in Innovation Management at an Austrian University of Applied Sciences and takes place in the second semester. The students' English proficiency ranges between B2 and C1. Altogether, the cohort consists of 44 students across two groups.

In addition to an oral exam (a presentation on a technical topic) and class participation, students are required to complete a written exam. The written exam includes vocabulary tasks, graph descriptions, and open-ended questions. In line with the principles of constructive alignment and to ensure transparent exam preparation, students should have the opportunity to practise their writing. However, finding sufficient time to provide detailed corrections can be challenging, and feedback is often underutilised. To address this, we employed an AI-tool for in-class writing practice. Texts submitted through this tool were not graded; they were used solely for formative purposes.

The tool we used does not require students to register. Furthermore, students can submit an initial version of their text, receive feedback, and then upload a revised version for additional feedback. This process adds an extra step compared with traditional homework systems, giving students the opportunity to actively apply feedback.

In this study, we designed two tasks in the AI tutoring tool and administered a questionnaire comprising Likert-scale items and open-ended questions to explore students' experiences with the feedback. Although the sample size was small and the findings should therefore be interpreted with caution, the combined insights from teachers, student texts, and survey responses provide an initial perspective on the use of AI-generated feedback in the university language classroom.

4 RESULTS

4.1 Writing tasks

Regarding the tasks, we designed two assignments – one focused on describing a graph and the other on discussing presentations – and established criteria that could be weighted. As anticipated, the quality of the prompts had a direct impact on the quality of the feedback. An analysis of the feedback generated by the AI tool shows that it was generally neutral in tone, while also incorporating motivating elements and illustrative examples. For instance, it began with general feedback on the overall text before providing feedback on the individual criteria.

The results could be accessed by the teacher either at the level of individual students or in an aggregated form for the entire group, allowing for both personalised monitoring and an overview of collective progress.

The outcomes appear somewhat mixed, which is not unexpected given that the AI tool was employed for the first time and primarily for formative rather than summative purposes. The data indicate that,

overall, the final versions of student texts demonstrated improvements compared to the initial drafts. Nevertheless, because the activity was explicitly framed as a practice exercise, a number of students opted not to revise their first draft or submit a second version (see Figure 1).

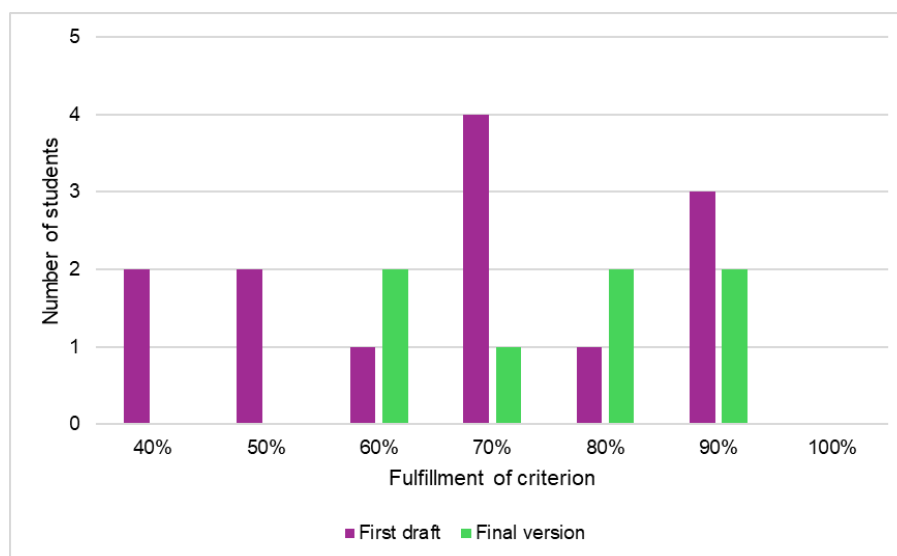


Figure 1. Cumulative results of students' writing for one criterion of one task

4.2 Questionnaire

14 students answered the anonymous questionnaire we sent out via Microsoft forms. The low response rate is plausibly explained by the timing of the survey distribution, which occurred at the end of the semester when students were heavily engaged with examinations and assignment deadlines. While this explanation is reasonable, the limited number of responses is, of course, not entirely satisfactory. Although the small sample size precludes claims of statistical significance, it nonetheless offers valuable initial insights into how learners perceive AI-generated feedback in writing practice. As an exploratory step, the findings reveal general trends, areas of acceptance, and points of criticism that may guide more comprehensive studies in the future.

Overall, students tended to view the AI feedback positively. When asked about its helpfulness, more than three quarters described it as either very or somewhat helpful. Only a small minority expressed that it was unhelpful or made no difference to their writing, as can be seen in Figure 2.

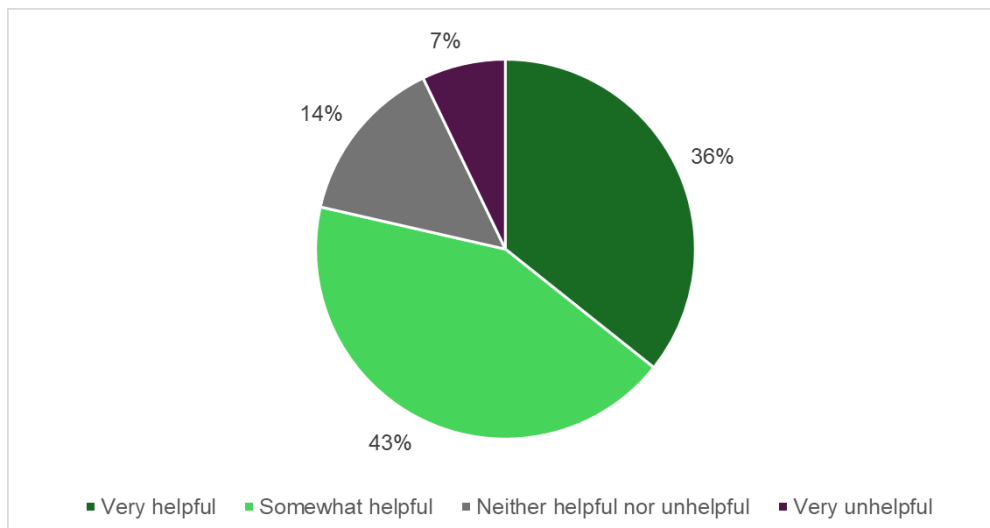


Figure 2. Students' answers to the question:
"How helpful did you find the AI-generated feedback on your writing?"

This suggests that, even at an early stage of implementation, AI has the potential to play a supportive role in students' writing processes.

When reflecting on the most useful aspects, students frequently mentioned the AI's neutrality, its ability to combine constructive criticism with examples, and its recommendations for vocabulary and sentence building. One respondent highlighted that the system was *"neutral, no matter the personal issues,"* while another noted, *"It criticized and also gave examples."* Others valued the linguistic focus, mentioning that *"the recommended words and tips on sentence building"* were particularly useful. These qualities highlight the perceived strengths of AI in offering objective and practical guidance. At the same time, however, some students also raised criticisms. One mentioned that *"the Score-meter was a little bit confusing,"* while another described the feedback as too rigid. Such features, while designed to provide clarity, may risk demotivating students if they reduce space for individual expression.

When asked how they felt reading the feedback, more than half reported feeling either neutral, encouraged, or motivated to revise their texts. One student explicitly stated that the feedback made them feel *"motivated to revise."* However, around 20% of respondents reported confusion or discouragement. This indicates that while the majority experienced the feedback as motivating or at least neutral, a smaller but notable portion felt constrained or unclear about how to proceed. The structured nature of AI output may explain why some students perceived the feedback as limiting rather than supportive.

Despite these reservations, the majority of respondents indicated that they revised their work based on the AI's suggestions. More than half revised partly, and about one third revised fully. Only a small number chose not to revise at all. As one participant put it, they engaged because the feedback was *"very helpful."* Thus, a significant majority engaged in at least some revision, suggesting that AI feedback had a tangible and practical impact on students' writing processes.

When asked about future use, nearly all students expressed a desire to receive AI-generated feedback in subsequent writing tasks. Some saw it as an essential companion, with one respondent writing, *"Yes on all of the writing tasks,"* while another emphasised its role as a *"neutral backup on my writing tasks."* Others pointed to its practical value, stating, *"Yes, I would like to because the feedback was very helpful."* Only one respondent expressed caution, suggesting that *"It should not be used constantly"*. These comments reflect a strong demand for AI feedback, tempered by a recognition that its role should be supportive rather than dominant. The findings also indicate a notable level of trust in AI as a reliable contributor to the learning process.

In considering the balance between AI and human feedback, responses reflected diverse perspectives. Some students clearly preferred an equal distribution, with one stating simply *"50:50."* Others leaned

toward AI-led feedback, suggesting that *“Always AI and the teacher looks over the feedback”* would be sufficient. Another respondent admitted a preference for AI, noting, *“I would not mind both, but I like the AI a little bit more.”* Others emphasised that instructor feedback is more personal and individual, noting that the teacher also serves as a *“sparring partner”* in class. These differing positions illustrate the negotiation between efficiency and depth: While AI is valued for its immediacy and neutrality, human teachers are still considered essential for providing context, nuance, and motivational support.

In summary, the findings reveal that students generally value AI-generated feedback for its neutrality, practicality, and potential to support revision. At the same time, concerns about its overly structured nature suggest that AI systems need to balance clarity with flexibility, allowing room for creativity and personal voice. While these initial results are limited to a small sample, they underline the promise of AI as a complementary feedback tool, best used in combination with the interpretive depth and empathetic guidance that human teachers provide.

5 CONCLUSIONS

The benefits of AI-supported formative feedback extend beyond immediacy and scalability. Automated feedback facilitates more iterative drafting cycles, allowing students to revise multiple times without the delays typically associated with instructor comments. In courses with large enrollments, this can substantially increase opportunities for meaningful engagement with feedback. To realise these benefits, however, it is essential that students actively take advantage of the opportunities AI-supported feedback provides. The perceived neutrality of AI responses may also help to reduce anxiety, encouraging some students to take risks and experiment with revisions. Nonetheless, these advantages depend heavily on the quality of prompts and criteria established by educators; vague or overly general input is likely to produce inconsistent or unhelpful feedback.

Pedagogically, integrating AI into feedback processes requires thoughtful planning. Educators must decide at which stages of learning AI is most useful – for example, in early drafting versus final polishing – and prepare students to engage critically with machine-generated advice. The importance of reflection can never be underestimated: Teachers should review AI feedback with students, discussing its strengths, limitations, and alignment with learning goals. This practice not only ensures quality control but also fosters media literacy, equipping students to navigate AI tools independently in future academic or professional contexts.

Policy implications are equally important. Universities should provide structured support for lecturers who wish to adopt AI in feedback processes, including training on prompt engineering, ethical considerations, and data privacy. Centralised, privacy-compliant platforms can reduce risks associated with commercial AI tools while ensuring consistent standards across courses. Clear institutional guidelines are needed to define appropriate uses of AI feedback, clarify its relationship to assessment policies, and communicate transparently with students about how their data is handled.

The student survey findings highlight the importance of actively involving learners in these discussions. Their responses reveal both enthusiasm and caution: while many welcome AI as a time-saving and motivating tool, they also acknowledge that it cannot match the personalisation of human feedback. Furthermore, for students to accept the tool and use it effectively, it needs to be integrated consistently so that they become familiar with it. Policymakers should regard AI not as a replacement for educators, but as a complement that enhances existing pedagogical practices. Targeted faculty development and clear communication strategies will be essential to building trust and ensuring that AI feedback supports learning rather than undermines it.

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