AI in the Hieroglyphic Classroom? A Pilot Study of Human-in-the-Loop Assistance, Cognitive Load, and Pedagogical Integration

Alexandre A Loktionov[1,2], Innokentiy Humonen[3], Maksim Golyadkin[1], Valeria Rubanova[4], Ekaterina Alexandrova[1], Ilya Makarov[3,5]

[1]HSE University, Moscow
[2]University of Cambridge, Cambridge
[3]AXXX, Moscow
[4]ITMO University, St. Petersburg
[5]Trusted AI Center, Russian Academy of Sciences, Moscow

The use of AI in ancient language studies raises a fundamental pedagogical question: when does assistance support philological learning, and when does it risk replacing core skills that students need? This paper addresses this dilemma through a pilot study of AI-assisted hieroglyphic reading, focusing on Ancient Egyptian as a low-resourced, non-alphabetic textual tradition in which reading competence depends on slowly building up integrated knowledge of signs, transliteration, grammar, and contextual analysis.

The study compares manual and AI-assisted workflows using PyThoth, a human-in-the-loop system offering sequential suggestions for sign recognition, transliteration, and translation. Participants at different career stages, from students to experienced researchers, worked with original hieroglyphic passages and completed questionnaires before and after doing a translation task manually and with PyThoth. These measured not only perceived usefulness and ease of use, but also workload, learning value, confidence in independent judgement, and the perceived professional legitimacy of AI-assisted work. Open-ended responses and written expert feedback further contextualised the questionnaire data.

The results show that AI assistance is neither simply a pedagogical threat nor an unambiguous gain. Some participants deemed the AI system useful, especially for initial sign recognition and making unfamiliar texts more approachable. This points to a possible scaffolding function: AI can help learners and researchers move more quickly from low-level decoding to higher-level interpretation. At the same time, the AI introduced new burdens. Limitations in the setup of the human-AI interface, repeated correction steps, uncertainty about the reliability of suggestions, and the need to verify intermediate outputs could increase perceived workload rather than reduce it. In this sense, AI redistributed cognitive effort rather than removing it.

The contrast between student expectations, experience-based evaluations, and senior expert reservations is particularly important for educational practice. Positive attitudes toward AI were often conditional: participants valued assistance when it remained

transparent, correctable, and subordinate to philological judgement. Negative reactions, including principled refusal to participate in the study, centred on the fear that AI might weaken students' ability to acquire vocabulary, grammar, source criticism, and the habits of independent textual work. Concerns about AI potentially replacing professional Egyptologists (including as a cost-cutting measure that would sacrifice academic quality for perceived economic efficiency) were also raised. These reservations should not be dismissed as mere resistance to innovation; they identify a real pedagogical boundary between assistance and substitution.

We argue that responsible AI integration in ancient studies requires explicit attention to cognitive load, autonomy, and skill formation. For philological education, the relevant question is not whether AI should be accepted or rejected, but how workflows can be designed so that AI functions as an interpretative assistant: useful for comparison, error detection, and access to difficult material, yet unable to replace the disciplined practice through which philological expertise is formed. For professional development of more senior scholars, reassurance must be provided that AI will be there to enhance their scholarly practice, and not to force researchers out of jobs.