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Writing to Engage: Handwriting as an Embodied and Relational Learning Practice

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Abstract: Digital and AI-mediated educational environments are transforming writing practices and raising questions about the pedagogical significance of handwriting. This conceptual article examines handwriting not as a technique inherently superior to digital writing, but as a learning practice whose educational value depends on task design, learner characteristics, and context. Drawing on scholarship on fine motor processes, student engagement and language awareness, the article develops three interconnected analytical perspectives to analyse writing processes and products: embodied engagement, learner agency, and relational engagement. It discusses the sensorimotor organisation of handwriting, opportunities for intentional choice and reflective authorship, and the social negotiation of written meaning. The framework also considers graphomotor fluency, accessibility, and the complementary use of handwritten and digital activities. Reporting empirical findings on the benefits of handwriting, the article offers a theoretically informed basis for pedagogical design and future research into writing practices in increasingly digital learning environments.

Keywords: handwriting; student engagement; learner agency; embodied learning; writing practices.

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1. Introduction: Writing practices in digital educational environments[1]

The increasing digitalisation of education is transforming not only the tools through which students learn and communicate, but also the cognitive, embodied and relational dimensions of their engagement with learning. The widespread use of keyboards and touchscreens, together with the rapid emergence of generative artificial intelligence, is progressively reshaping writing practices in educational contexts. Writing is increasingly performed through digital interfaces that facilitate the processes, and consequently the final product. Specifically, it intervenes in the production, revision, circulation, and transformation of texts. Remarkably, it allows and introduces brand new possibilities for generating linguistic content and supporting written communication.

Within this scenario, handwriting risks being regarded primarily as an instrumental skill associated with the early stages of literacy and, consequently, as a practice that may

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gradually be replaced by digital technologies. Such a perspective, however, may underestimate the pedagogical complexity of handwriting and the multiple processes involved in the act of writing by hand. Beyond its function as a means of recording information, handwriting involves the coordination of motor activity, perception, attention, linguistic representation, and intentional action. It is therefore worth considering that its educational significance extends beyond the acquisition of a technical competence.

At the same time, it is necessary to consider that writing, as an epistemic practice (Savoia, Zagorulko, 2026) is not merely a means of transmitting knowledge, but a symbolic resource through which learners construct, interpret, and negotiate meaning. Writing, both handwriting and in digitally mediated contexts, and its educational value, should be examined in relation to reflective meaning-making, rather than exclusively to the efficiency of textual production.

This contribution proposes to reconsider handwriting as a complex activity which encompasses among other aspects embodied, expressive, and relational learning practice that may contribute to student engagement and learner agency (Faircloguh, 1992). The central argument is not that handwriting should be considered intrinsically superior to digital writing, nor that educational practices should resist technological innovation. Rather, different writing modalities create different conditions for interaction between learners, their bodies, cognitive processes, symbolic systems, and learning environments. The pedagogical question consequently concerns not simply which writing medium should be preferred, but which forms of engagement different writing practices may support and under which educational conditions.

Against this background, the contribution addresses the following research question: How can handwriting be conceptualised as a pedagogical practice capable of supporting student engagement in increasingly digital and AI-mediated learning environments?

Its aim is to develop a conceptual framework connecting research on handwriting, fine motor processes, cognition, and learning with multidimensional understandings of student engagement. More specifically, the paper proposes three interconnected analytical dimensions—embodied engagement, learner agency, and relational engagement—through which handwriting can be interpreted as an educational practice involving bodily participation, personal investment, and socially situated meaning-making.

2. Handwriting and cognition: the educational significance of fine motor processes

The relationship between handwriting and learning cannot be reduced to the mechanical acquisition of graphic skills. Writing by hand requires the coordination of perceptual, motor, and cognitive processes that develop through practice and become progressively integrated into more complex forms of written expression. The production of a handwritten text involves the organisation of movements, spatial orientation, visual monitoring, and the simultaneous management of linguistic content. These processes suggest that handwriting should be considered within a broader understanding of learning in which cognitive activity and motor coordination are interconnected (Wolf, 2018; Angelini, 2018).

Research on fine motor development provides a relevant foundation for this perspective. Cameron et al. (2012), investigating the contribution of fine motor skills and executive functions to kindergarten achievement, identified distinct associations

between these abilities and early academic performance. Their findings suggest that motor competences and executive processes represent relevant components of school readiness and educational development. Although this research does not establish that handwriting itself produces improvements in executive functioning, it supports the importance of considering motor activity within the broader organisation of learning processes.

A complementary perspective emerges from studies comparing handwriting and keyboard writing. Mangen et al. (2015) examined the effects of different writing modalities on word recall and recognition, identifying differences in free recall associated with handwriting in the experimental conditions investigated. These findings suggest that the material and sensorimotor characteristics of writing may be relevant to certain memory processes. However, their implications should be interpreted cautiously, given the specific tasks and participant characteristics involved. They do not establish a general cognitive superiority of handwriting across educational contexts.

The pedagogical relevance of these studies lies in their contribution to a more complex understanding of writing as an activity involving multiple dimensions of human functioning. Handwriting requires learners to coordinate the production of graphic signs with the organisation of linguistic meaning. The gesture of writing is therefore not separable from the processes through which written language is produced, monitored, and interpreted.

From this perspective, the educational significance of handwriting cannot be evaluated exclusively through the efficiency or formal accuracy of written production. It also concerns the type of the learner's participation in the writing process, which involves a broader theoretical construct and requires further reflection and analysis.

3. From student engagement to a pedagogical framework for handwriting

Student engagement has been widely conceptualised as a multidimensional construct that encompasses different aspects of learners' participation in educational activities. Fredricks et al. (2004) distinguish behavioural, emotional, and cognitive engagement, highlighting the need to move beyond interpretations centred exclusively on observable participation or task completion. Engagement concerns not only whether students participate in learning activities, but also how they invest attention, emotion, and cognitive effort in those activities.

This multidimensional perspective is particularly relevant to writing, which simultaneously involves observable behaviour, cognitive organisation, emotional investment, and interaction with symbolic systems. A student may complete a written task without necessarily experiencing meaningful engagement with its content. Conversely, writing may become an opportunity for reflection, exploration, and personal elaboration when the activity encourages learners to make choices, develop ideas, and recognise the significance of their own production.

Building on the multidimensional understanding proposed by Fredricks et al. (2004), the present contribution develops a framework specifically oriented towards the pedagogical characteristics of handwriting. The proposed dimensions do not reproduce the original behavioural, emotional, and cognitive categories, nor should they be interpreted as an empirically validated alternative to them. Rather, they represent an analytical reorganisation intended to examine how the material, expressive, and communicative characteristics of handwriting may contribute to engagement.

The originality of this approach lies in shifting attention from the writing medium considered in isolation to the forms of educational participation that may emerge through particular writing practices. Handwriting is consequently examined not as a universally advantageous technique, but as a potential resource for designing meaningful learning experiences.

The perspective of analysis is, consequently, organised around three interconnected pedagogical perspectives. Embodied engagement concerns the sensorimotor and cognitive participation involved in handwriting. Learner agency refers to the intentional and reflective participation of students in the construction and revision of written meaning. Relational engagement addresses writing as a socially situated practice through which learners communicate, negotiate meanings, and participate in shared educational experiences. These perspectives are analytically distinguishable but may interact within the same writing activity.

4. Embodied engagement: Writing as intentional bodily participation

Embodied engagement, concerns the bodily and sensorimotor participation involved in writing. Handwriting requires the coordination of perceptual, motor, and cognitive processes: the writer controls movement, pressure, direction, spatial organisation, and rhythm while simultaneously selecting, organising, and representing linguistic content.

Unlike a purely instrumental interpretation of handwriting, this perspective considers bodily action as an integral component of the writing experience. The written trace emerges from an intentional gesture and remains materially connected to the movement through which it was produced. The writer can observe the progressive formation of graphic signs and intervene directly in their organisation, establishing a continuous relationship between action, perception, and representation.

Such characteristics do not imply that digital writing lacks bodily or cognitive dimensions. Keyboard and touchscreen interactions also involve motor coordination, perceptual monitoring, and intentional activity. The distinction concerns the different configurations of sensorimotor participation associated with each modality.

In handwriting, the production of individual graphic forms requires differentiated movements and continuous spatial organisation. These characteristics may create opportunities for forms of engagement in which attention is directed not only towards linguistic content but also towards the material process of its construction.

Embodied engagement therefore refers to the learner's active participation in producing meaning through coordinated bodily and cognitive activity. Its educational relevance is particularly evident when writing tasks encourage observation, annotation, graphic organisation, and the progressive elaboration of ideas. In such circumstances, the handwritten page may function as a space in which thought becomes visible, revisable, and materially organised.

Nevertheless, embodied participation should not be confused with automatic cognitive benefit. The educational value of handwriting depends on the characteristics of the task, the learner's competences, and the conditions under which writing takes place. For students experiencing substantial graphomotor difficulties, handwriting may require considerable effort and potentially interfere with higher-order composition processes. The pedagogical objective is therefore not to maximise handwriting indiscriminately, but to identify circumstances in which its sensorimotor characteristics can support meaningful participation.

5. Handwriting and learner agency

Learner agency represents a significant pedagogical construct for understanding students' capacity to act intentionally, exercise judgement, and participate actively in the construction of knowledge. Within writing practices, agency can be examined in relation to learners' opportunities to formulate ideas, make linguistic and rhetorical choices, revise their interpretations, and assume responsibility for the meanings they produce. Writing is not merely a process through which information is recorded or reproduced; it may also constitute an activity through which learners develop a relationship with their own ideas and recognise themselves as participants in the construction of meaning.

Handwritten production is characterised by individual variation and by a visible connection between the writer and the written trace. These characteristics may contribute to the perception of the written product as the outcome of personal action. However, the expressive value of handwriting should not be assumed to emerge automatically from the use of pen and paper. It depends on the opportunities for choice, reflection, and authorship provided by the educational activity.

Writing is as a socially situated epistemic practice in which learners can become conscious of their linguistic and rhetorical choices and recognise themselves as participants in knowledge construction. Applied to handwriting, this perspective does not imply that pen-and-paper production generates agency in itself. Rather, handwritten drafting, annotation, and revision may provide opportunities to exercise agency when educational tasks make room for deliberate choices, reflection on language, and responsibility for the meanings produced (Savoia, Zagorulko, 2026).

Within this framework, learner agency refers to the capacity to act intentionally in the learning process, make decisions, formulate and revise ideas, and recognise one's contribution to the production of knowledge. Handwriting may support such experiences when students are encouraged to use writing for personal elaboration rather than exclusively for transcription or reproduction.

Reflective journals, handwritten annotations, exploratory notes, and preliminary drafts offer examples of activities in which writing may become a space for developing an intentional relationship with learning. These practices can encourage learners to formulate questions, identify uncertainties, reconsider previous interpretations, and progressively organise their thinking.

This goal must also take account of the experience of time within writing. Handwriting may create opportunities for a slower and more deliberate form of production, particularly when tasks are designed to privilege reflection over immediate completion. The educational significance of this aspect is in that it enables learners to engage more consciously with the content and purposes of their activity.

In increasingly AI-mediated environments, this dimension acquires particular relevance. When linguistic content can be generated or reformulated through automated systems, educational practices must also provide opportunities for students to exercise judgement, articulate personal positions, and assume responsibility for their written production. Handwriting may represent one possible means of supporting these processes, provided that it is integrated into activities explicitly oriented towards reflection and authorship.

The practice of writing extends beyond the individual learner. Writing is always situated within linguistic, cultural, and social practices. It enables individuals to communicate, address others, participate in shared symbolic worlds, and construct relationships through language.

From this perspective, the educational significance of writing cannot be understood exclusively in terms of individual cognitive performance. Written production also involves the capacity to recognise communicative purposes, anticipate readers, negotiate meanings, and participate in socially organised forms of expression.

The concept of language awareness (Svalberg, 2007; James & Garrett, 1991) provides a relevant pedagogical connection. Education can promote a more conscious relationship with language, encouraging learners to recognise its complexity and reflect on the ways in which linguistic practices contribute to the construction and interpretation of meaning (Savoia, 2020). Writing activities may support this orientation when students are invited to consider not only what they communicate, but also how and why they make particular linguistic choices.

Within this perspective, handwriting may be understood as one possible form of situated communicative practice. Handwritten comments, shared annotations, reflective exchanges, and collaborative interpretation of texts can create opportunities for interaction between learners, teachers, and written materials.

6. Pedagogical implications: Integrating handwriting and digital practices

The three perspectives proposed in this contribution offer a conceptual basis for reconsidering the role of handwriting within contemporary curriculum design. Their educational relevance does not require the restoration of handwriting as the dominant or exclusive writing modality. Instead, they invite educators to design learning experiences in which analogue and digital practices are selected and combined according to their pedagogical purposes.

Activities involving handwritten conceptual maps, exploratory notes, reflective journals, and annotations may provide opportunities for embodied participation and personal elaboration. Digital writing environments, in turn, may facilitate collaborative revision, accessibility, multimodal composition, and the circulation of texts among different audiences.

The integration of these modalities can be particularly meaningful when students move between individual reflection and collaborative production. For example, an educational sequence might begin with handwritten notes intended to formulate preliminary interpretations, continue through discussion and comparison with peers, and conclude with the collaborative production of a digital text. In such a sequence, handwriting and digital writing are not competing practices but complementary resources serving different educational functions.

The design of these sequences should also take account of the developmental trajectory of handwriting. Angelini (2026) emphasises that graphic fluency emerges through progressive practice and the integration of motor, perceptual, and cognitive prerequisites. Accordingly, activities may combine short, supported handwriting tasks with opportunities for reflection, feedback, and revision, rather than assuming that extended handwriting practice is equally appropriate for all learners.

The proposed framework also encourages attention to individual differences and accessibility. Learners vary in their motor competences, writing fluency, linguistic abilities, and preferences. Consequently, the same writing modality may create opportunities for engagement for some students while imposing additional demands on others. Inclusive educational design requires flexibility in the selection of writing tools and sensitivity to the relationship between task demands and learning objectives.

The renewed attention to handwriting in discussions surrounding the *Italian Indicazioni Nazionali per il curricolo* can be situated within this broader pedagogical debate. Reflections on cursive writing and its relationship with the development of thought (Angelini, 2026), invite reconsideration of handwriting as an educationally meaningful activity. Such arguments, however, should be distinguished from empirical evidence demonstrating specific learning effects.

In this sense, maintaining handwriting within educational practices should not be understood as the preservation of tradition for its own sake. It represents an opportunity to reconsider the plurality of experiences through which learners interact with language, knowledge, and one another.

The relationship between handwriting fluency and cognitive resources further complicates pedagogical decisions. Developing graphomotor automaticity involves the progressive coordination of motor, perceptual, and executive processes (Vertecchi, 2015; Angelini, 2026). Where transcription remains effortful, handwriting may compete with higher-order composition for attentional and working-memory resources; conversely, greater fluency may allow learners to allocate more attention to meaning-making. These possibilities should be examined in relation to learners' developmental trajectories and task demands rather than assumed to apply uniformly.

7. Discussion and directions for future research

The framework developed in this contribution proposes a shift from evaluating handwriting primarily as a technical competence to examining it as a potentially meaningful educational practice. Its three perspectives—embodied engagement, learner agency, and relational engagement—are interconnected analytical lenses rather than independent or universally observable effects of handwriting.

A single writing activity involves a plurality of processes such as: bodily coordination, cognitive attention, emotional investment, intentional decision-making, and communication. Moreover, the relative significance of these dimensions will depend on the educational context, the characteristics of learners, and the purposes of the activity.

The contribution is conceptual rather than empirical, but it is founded on Internationa research conducted on the field (Vertecchi, 2015; Angelini, 2018; Savoia, 2020; Mangen, xxx). If these studies don't establish causal relationships between handwriting and student engagement, it offers ground to consider that handwriting produces favourable educational outcomes that must not be dismissed and totally replaced by digital writing. As a consequence, it may be of use to formulate a theoretically informed perspective capable of guiding subsequent pedagogical investigation.

Further research can examine how the proposed dimensions manifest themselves across different educational contexts and developmental stages. Qualitative studies might investigate learners' experiences of handwritten and digital composition, while observational research could explore the relationships between writing practices, participation, and self-regulation. Comparative studies could also investigate how particular combinations of analogue and digital activities relate to different dimensions of engagement, taking account of learners' prior competences and the characteristics of the tasks.

The three perspectives can intersect within a single educational sequence. For example, handwritten annotations may involve the spatial and sensorimotor

organisation of ideas (embodied engagement), deliberate selection and revision of interpretations (learner agency), and subsequent exchange of annotations with peers (relational engagement). This example illustrates a possible pedagogical configuration. Future studies could operationalise the three perspectives through observations of task participation, analyses of revisions, and interviews about learners' perceived authorship and collaborative meaning-making, while also considering accessibility and graphomotor fluency.

8. Conclusion

In increasingly digital and AI-mediated educational environments, reconsidering handwriting does not imply resisting technological change. Rather, it requires recognising that writing is a complex educational practice involving more than the production of linguistic content.

The proposed framework conceptualises handwriting through three interconnected pedagogical perspectives: embodied engagement, learner agency, and relational engagement. Together, they offer a basis for examining how writing activities may support bodily participation, intentional action, reflection, authorship, and socially situated meaning-making.

The central educational challenge is therefore not to establish a hierarchy between handwriting and digital writing, but to develop informed practices that recognise their different possibilities and limitations. Preserving meaningful opportunities for handwriting may contribute to this objective when such activities are designed in relation to explicit educational purposes and integrated within inclusive, technologically enriched learning environments.

Ultimately, writing to engage means creating conditions in which learners do not simply produce texts, but participate consciously in the processes through which meaning is constructed, expressed, negotiated, and shared.

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