Advancing AI Literacy in Danish TVET through Craftsmanship and Socio-Material Perspectives

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Abstract
The rapid development of artificial intelligence (AI), particularly generative AI, is transforming how knowledge, skills, and competences are understood and enacted in Technical and Vocational Education and Training (TVET). Such transformation raises pressing questions about how AI literacy can be meaningfully advanced within educational traditions grounded in material practice and professional identity. Drawing on socio-material theory and Richard Sennett's notion of craftsmanship, this paper conceptualizes AI literacy as a situated, networked, and relational practice rather than a purely cognitive or technical skill. The paper introduces a framework consisting of five learning strategies: AI Independent, AI Aware, AI Supported, AI Enhanced, and AI Centric learning developed within the Danish GenAISTEM-project. These strategies illustrate how learners can progress from foundational manual mastery toward hybrid forms of digital–material craftsmanship and critical engagement with AI. In this perspective, AI is understood not simply as a tool but as an active participant in educational assemblages that connect humans, technologies, and educational settings. This paper presents part of an ongoing research project which applies a design-based research approach. As part of the research project, we are currently conducting document analysis of ministerial orders for TVET. A preliminary analysis from bricklayer education exemplifies how knowledge, skills, and competences can be mapped across the five strategies. The findings highlight that the fundamentals of craftsmanship remain essential for developing critical AI literacy in TVET. First, students must be able to act independently of AI to later evaluate, collaborate with, and shape it responsibly. Conversely, AI-centric learning opens new possibilities for innovation, design, and ethical reflection, challenging conventional boundaries between human and machine agency. By combining craftsmanship with socio-material and networked learning perspectives, the framework contributes to current debates on what it means to be skilled in an age of intelligent technologies. It provides a vocabulary for teachers and researchers to discuss progression, agency, and relations in AI-integrated vocational education. Future research will extend the analysis of ministerial orders across vocational domains to examine how AI-related, craft-specific, and transversal competences are recognized, aligned, and developed within networked learning environments.

Keywords
AI, literacy, TVET, AI literacy framework, competency mapping, document analysis

Introduction

The integration of artificial intelligence (AI) into education has sparked a wide range of frameworks for AI literacy (Almatrafi, Johri & Lee, 2024; UNESCO, 2024a, 2024b). Yet technical vocational education and training (TVET) contexts remain underexplored. In the GenAISTEM-project, we study how generative AI can be integrated meaningfully into TVET, guided by socio-material theory (Johri, 2011, 2022) and Sennett's (2008) notion of craftsmanship.
Based on a preliminary analysis of ministerial orders, we present an overview of the learning outcomes described as essential for the TVET in question (bricklayer). This work is part of our ongoing research project on knowledge, skills and competences needed for TVET-students to be able to employ specific, suggested learning strategies (Riis, 2025) and thus further their AI literacy.

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Theoretical Background

Existing AI literacy frameworks provide important guidance for educational leaders, teachers and students. However, they are often developed for general education and lack adaptation to vocational domains (Perkins et al., 2025). Socio-material theory (Johri, 2011, 2022) emphasizes that learning is shaped by the entanglement of humans, tools, and material environments. In this perspective, AI is not merely a tool but an active participant in the learning assemblage, and this approach moves beyond deterministic views of AI as either disruptive or beneficial and instead considers how AI (already) entangles with human, material, and institutional elements to reconfigure learning and pedagogy (Bearman & Ajjawi, 2023, Bhatt, 2023).

Craftsmanship, according to Sennett (2008), is defined as the desire to do a job well for its own sake. It is not limited only to traditional crafts (e.g., woodworking or pottery) but extends into all kinds of skilled practice, including medicine, software programming, music, teaching. Sennett emphasizes quality, pride in work, personal investment, and a sustained commitment to continuous improvement. Integrating Sennett's ideas of craftsmanship with AI literacy provides an enriched perspective, moving AI education from merely technical skills acquisition to a deeper, reflective, and ethically informed practice – cultivating a generation of thoughtful, critical, and skilled AI craftspeople. By combining these perspectives, we frame AI literacy in TVET as a practice that extends beyond technical competence into reflective, ethical, and situated engagement with both digital and material dimensions of craft.

Research Context

The GenAISTEM-project (2024-2026) is a collaboration between Danish University Colleges Absalon and VIA and Center for IT in VET-teaching (CIU). 60 teachers and 15 leaders from five technical vocational schools participate. The project applies a design-based research approach to study AI literacy in Danish TVET. Teachers and leaders in various technical vocational educations are engaged in iterative cycles of co-design, experimentation, and reflection with and on the use of Generative AI in teaching and learning.

In the project, we develop several tools for teachers, pupils and school leaders to help them address the role of AI in teaching, learning and professional practices. In this paper, we focus on a framework presenting learning strategies for AI literacy.

Five Learning Strategies for advancing AI literacy

Inspired by Perkins et al. (2024), we propose a framework consisting of five learning strategies for advancing AI literacy: AI independent, AI aware, AI supported, AI enhanced, and AI centric learning. It may seem counterintuitive to include a strategy that is AI independent. However, our assessment is that the fundamentals of a subject or a craft has never been more important. Without romanticizing craftsmanship, we will go so far as to argue that students cannot become AI literate without this since it is precisely this type of knowledge which is needed to validate output from AI. At the other end of the spectrum, we find the full integration of AI. A strategy that speaks precisely to the fact that students should also possess basic knowledge and understanding of AI as a subject.

The proposed strategies accentuate that learning occurs in the interplay between human capabilities and the affordances of available tools. While we have developed short descriptions of each strategy (Riis, 2025) we do not believe that they are sufficiently actionable at this level; both students and teachers need more detailed information to grasp what is required to engage in these strategies.

Preliminary analysis exemplified through bricklayer education

Based on the ministerial orders for different types of TVET combined with insights from socio-material theory and craftsmanship, we are in the process of analysing knowledge, skills and competences. In table 1 below, we present findings from bricklayer education with regards to two opposing strategies from the framework.

As argued by Christensen et al. (2025), literacy designs must move beyond purely intellectual practices to include bodily, material, and more-than-human forms of participation. Bricklayer education illustrates this vividly: learning to build with both bricks and algorithms involves muscular memory, sensory calibration, and algorithmic awareness exemplifying different forms of post digital literacy enacted through craft.

In the project, we engage with potentially 40+ different vocational educations, and in our continued work with mapping knowledge, skills and competences, we already see some interesting trends in terms of expected learning outcomes. Early findings indicate three interrelated competence domains: **AI-related** (understanding, using, evaluating generative AI), **Craftsmanship** (embodied and vocationally specific skills and dispositions), and **General/Transversal** (critical thinking, ethics, collaboration and communication).

Table 1: Overview of knowledge, skills and competences

Strategy	**AI-related (Generative AI)**	**Craftsmanship (Bricklayer focus)**	**General/Transversal**
AI Independent Learning	Knowledge: Awareness that GenAI exists but is not applied.	Knowledge: Materials (brick types, mortar properties, bonding principles).	Knowledge: Safety rules, basic math for measurement.
	Skills: Compare personal explanations with AI-generated descriptions afterwards (meta-awareness).	Skills: Manual laying of bricks, measuring, levelling, cutting.	Skills: Document work manually (drawings, notes).
	Competences: Distinguish between embodied learning and abstract descriptions.	Competences: Patience, perseverance, error recognition, embodied judgment.	Competences: Self-reflection, learning from mistakes.
AI Centric Learning	Knowledge: How GenAI systems are trained; data, bias, limits.	Knowledge: Historical and cultural dimensions of masonry; how AI representations align/misalign with tradition.	Knowledge: Social and labour implications of AI in construction.
	Skills: Evaluate and tweak AI models for vocational use (e.g., generate alternative bonds, test outputs).	Skills: Innovate bricklaying patterns/designs with AI as material.	Skills: Communicate critical reflections beyond the workshop.
	Competences: Ethical AI literacy; agency in shaping tools, not just using them.	Competences: Pride in contributing to digital–material craft evolution.	Competences: Leadership, innovation, societal responsibility.

We also see some emerging patterns across the framework in relation to what could be called professional progression. In relation to the AI dimension, this moves from awareness → critical use → co-creation → algorithmic critique/design. The craftsmanship dimension moves from manual mastery → hybrid integration → digital craftsmanship, and finally the general dimension moves from personal discipline → ethical reflection → collaborative innovation → societal agency.
In summary, across the framework, a clear professional progression emerges, moving from **awareness towards algorithmic critique** in AI literacy, from **manual mastery towards digital craftsmanship** in skill development, and from **personal discipline towards societal agency** in transversal competences.

Further research

This paper has outlined a framework for advancing AI literacy in Danish TVET by integrating socio-material perspectives and Sennett's notion of craftsmanship. The proposed five learning strategies highlight that AI literacy develops through situated, material, and relational practices within which human and non-human actors co-produce knowledge, skills and competences. Our analysis suggests that generative AI does not diminish the importance of craft-based expertise but rather reframes this as a networked process of negotiation between humans, tools, materials, and institutional norms (i.e. ministerial orders).
Further research will continue the analysis of ministerial orders across different vocational programs to explore how AI-related, craft-specific, and transversal competences are articulated and valued. In the project, we will test the use of the framework and the competence mapping with TVET teachers and students. Our work will also examine how the proposed framework can support TVET-teachers and students in navigating the interplay between embodied practice and digital mediation - thereby contributing to broader discussions of Networked Learning in vocational contexts.

References

Almatrafi, O., Johri, A. & Lee, Y. (2024). A systematic review of AI literacy conceptualization, constructs, and implementation and assessment efforts (2019-2023). *Computers and Education Open*, 100173.

Bearman, M., & Ajjawi, R. (2023). Learning to work with the black box: Pedagogy for a world with artificial intelligence. *British Journal of Educational Technology, BJET, 54(5), 1160–1173.*

Bhatt, I. (2023). Postdigital Literacies. In P. Jandrić (Ed.), *Encyclopedia of Postdigital Science and Education. Cham: Springer. https://doi.org/10.1007/978-3-031-35469-4_15-2.*

Christensen, IM.F., Dohn, N.B. & Christensen, L.L.W. Designing for Literacy in a Postdigital World. *Postdigit Sci Educ (2025).* https://doi.org/10.1007/s42438-025-00583-*8*

Johri, A. (2011). The socio-materiality of learning practices and implications for the field of learning technology. *Research in Learning Technology,* 19(3), 207–217.

Johri A. (2022). Augmented sociomateriality: implications of artificial intelligence for the field of learning technology. *Research in Learning Technology*, 30. https://doi.org/10.25304/rlt.v30.2642

Perkins, M., Roe, J. & Furze, L. (2025). How (not) to use the AI Assessment Scale. *Journal of Applied Learning & Teaching,* Vol.8, No.2. ISSN: 2591-801x.

Perkins, M., Furze, L., Roe, J., MacVaugh, J. (2024). The Artificial Intelligence Assessment Scale (AIAS): A Framework for Ethical Integration of Generative AI in Educational Assessment. *Journal of University Teaching and Learning Practice*, 21(6).

Riis, M. (2025, Aug. 19). *Between wood and algorithms: Crafting AI literacy in TVET*. UNESCO. https://www.unesco.org/en/articles/between-wood-and-algorithms-crafting-ai-literacy-tvet?hub=81942

Sennett, R. (2008). *The Craftsman*. Yale University Press.

UNESCO (2024a). *AI competence framework for teachers*. https://unesdoc.unesco.org/ark:/48223/pf0000391104

UNESCO (2024b). *AI competency framework for students.* https://unesdoc.unesco.org/ark:/48223/pf0000391105

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