International Journal for Research in Vocational Education and Training (IJRVET)
2026, Vol. 13, Issue 3, 424–442
https://doi.org/10.13152/IJRVET.13.3.5

Vocational Teachers as AI Pioneers: A Study of Professional AI Competence in the Norwegian Vocational Field of Information Technology and Media Production

Svanhild Kristine Berntsen[1], Øyvind Granborg[1], Steinar Karstensen[1], Leif Christian Lahn[2], Nina Aakernes*[1]

[1]*Oslo Metropolitan University, Kunnskapsveien 55, 2007 Kjeller, Norway*
[2]*University of Oslo, Problemveien 11, 0313 Oslo, Norway*

Received: 20 May 2025, Accepted: 10 February 2026

Abstract

Context: Artificial intelligence (AI) integration into education is advancing rapidly, yet vocational education and training (VET) remains underexplored in AI and education research. The limited attention to VET is particularly salient given that vocational teachers are expected to prepare students for a digitalised labour market in which AI increasingly informs and transforms occupational practices. This article explores how vocational teachers in the Norwegian Information Technology and Media Production (ITMP) programme integrate AI in their teaching and how it affects their professional digital competence.

Approach: Using a qualitative, exploratory case study design, we investigated two upper secondary schools in Norway that were identified as early adopters of AI in vocational teaching. Data sources included interviews with four teachers, classroom observations, documents (e.g., assignments and presentations), and field notes from teacher-industry network meetings. The data were analysed using abductive thematic analysis, supported by generative AI tools to explore emergent patterns. We employed a framework for vocational teachers' professional digital competence to guide the analysis.

*Corresponding author: ninaa@oslomet.no

ISSN: 2197-8646
https://www.ijrvet.net

Findings: The study identifies three main deyvelopments. First, AI tools such as ChatGPT and image generators are widely used to support students' autonomous learning and enable real-time feedback in coding, design, and text-based tasks. Second, teachers use AI in profession-specific ways to enable students to develop digital products, business ideas, and portfolios, thus fostering creativity and entrepreneurship. Third, AI transforms teachers' professional identity and digital competence. They transition from knowledge transmitters to facilitators in a co-learning relationship with students and AI systems. Teachers also report relying on informal networks and personal initiative for upskilling, while systemic support remains limited.

Conclusion: Vocational teachers in the ITMP programme emerge as AI pioneers, developing innovative didactic practices and digital strategies through bottom-up experimentation. However, the findings also highlight tensions concerning assessment, deep learning, ethical concerns, and unequal access to AI tools. These point to the need for revised frameworks of vocational digital competence, targeted teacher training, and institutional support. The study contributes to the emerging field of vocational AI didactics and provides empirical grounding for future policy and curriculum development in VET.

Keywords: Artificial Intelligence, Curriculum Innovation, Digital Literacy, Teacher Professional Development, Vocational Education and Training, VET

1 Introduction

It is well accepted that artificial intelligence (AI) will have a disruptive impact on working life and skill requirements, but experts differ in their estimations of the magnitude and the dynamics of these transformations (Brynjolfsson & Lindsey, 2024; Organisation for Economic Co-operation and Development [OECD], 2023). The release of ChatGPT provided AI accessibility to the general public and has impacted the educational sector to such an extent that scholars are asking for a paradigm shift in curriculum design, instructional practices and evaluation methods (Gentile, 2023). A widespread concern in the growing research field of AI in education (AIED) is the gap between the proliferation of studies on technological advancements and the lack of critical research on their implementation in pedagogical practice (Holmes & Tuomi, 2022; Ifenthaler et al., 2024). This state of the art is particularly true for vocational education and training (VET), which on the one hand, is more exposed to AI-infused transformations in working life (Wuttke et al., 2020) while on the other hand, represents an under-researched field in AIED (Petridou & Lao, 2024). To counter this knowledge gap, more research is needed to develop a timely AI vocational pedagogy that is grounded in VET teachers' AI-mediated practices and professional competences and that provides well-founded guidelines (a didactic) for vocational training quality and teachers' competence development in an AI era.

The growth of AIED research has been paralleled by the emergence of policy-oriented frameworks (Miaio & Cukurova, 2024) and research models (Mikeladze et al., 2024) that define teachers' professional AI competences, but no such platforms have been established for VET teachers (Bekiaridis & Attwell, 2024[1]). In our study, we draw on a framework for VET teachers' professional digital competences (Lahn & Berntsen, 2023) that provides dimensions that will guide our explorations.

In this article, we present an exploratory study of how in-service VET teachers in the Norwegian education programme Information Technology and Media Production (ITMP) in upper secondary school integrate AI in the two-year school-based part of VET. The students (age 15–18) learn about user support, IT networks, IT security and programming, storytelling, photography, film, and visual communication, and in the school-based part, they engage in shorter projects with relevant companies. The school-based education prepares the students for two years of apprenticeship in training establishments within five recognised trades, leading to vocational certification as 1) IT Operations Technician working with the operation of IT systems. 2) IT Developer working with coding and programming and developing IT systems. 3) Content Producer working with designing digital content such as still images, live images, and audio recordings. 4) Media Designer working with graphic design for print and digital devices. 5) Media Technician working with film and TV production and technical equipment at conferences and cultural events (Utdanningsdirektoratet, 2020).

The ITMP programme was established in 2020 in response to a demand for more upskilled workers possessing a combination of technology, communication, and design expertise. We have strategically selected this programme as a critical case since it on one hand is expected to be at the forefront of digitalisation and AI competencies in the spectrum of vocational subjects. On the other hand, reviews of the research literature (Lahn & Berntsen, 2023; Ranuharja et al., 2025) conclude that there is no generally accepted recipe for what constitutes a high-quality AI-based pedagogy in VET. Thus, we may expect the teachers on the ITMP programme to be "AI pioneers" in an entrepreneurial way to the extent that they (1) advance integration of this technology in their teaching, (2) redefine professional roles and (3) surface AI digital competencies for VET teachers. These dimensions are partly similar to those guiding the European Erasmus+ network building project "AI Pioneers" (Bekiaridis & Attwell, 2024), but our study has a more targeted and explorative focus on how AI pioneering in pedagogy is achieved for VET teachers.

1 An Erasmus+ funded project entitled 'AI Pioneers' was carried out from 2023 to 2025, in the context of which Bekiaridis and Attwell (2024) published the supplement to the European Digital Competences Framework for Educators (DigCompEdu) focussing on AI competences. The project website can be found via the following link: https://aipioneers.org/

2 Research Review and Theoretical Framework

As pointed out above, research on vocational teachers' use of AI in VET is still in its early stages, whereas digitalisation and AI may, for several reasons, have a particular disruptive impact on the VET sector (Wuttke et al., 2020). First, given that educators in this sector prepare students for a labour market where digital skills and AI technologies are ubiquitous, they need to be familiar with occupation-specific AI hardware and software and possess the ability to incorporate such digital tools into their teaching practices. Secondly, the digital transformations of work and education strongly impact vocational didactics by forcing a reclassification of occupational domains, career paths and vocational subjects (Hiller & Zarnow, 2024; Petridou & Lao, 2024). Thirdly, recent research on the differential effects of AI on substituting or complementing human labour converges in concluding that quantitative changes are likely to be in terms of polarisation between sectors (Tyson & Zysman, 2022). By implication, vocational fields may evolve in very different directions and thereby challenge the sustainability of a general vocational pedagogy. Considering these transformational trends in AI-infused VET, the following summary will address both general themes of AIED in VET, subject-specific perspectives and will focus on VET teachers.

Reviews of AI in VET have mainly examined the potential and challenges of Generative AI (GenAI), notably Large Language Models (LLM) such as ChatGPT, in supporting a number of teaching and learning activities (Rongchang et al., 2024). In short, these range from generating realistic case studies and other instructional materials that assist teachers in designing learning tasks to content optimisation, process assistance evaluation and instant learning support /feedback. Personalised and customised teaching has special significance in VET where the range of students' proficiency levels is large and the subjects are broad and practice-based (Ranuharja et al., 2025). The versatility of GenAI and LLMs in providing interactive teaching assistance (Pozdniakov et al., 2024) may have an advantage over more structured AI technologies in such learning environments. Although combinations of GenAI and AI-driven tutoring systems, learning analytics and virtual simulation may be designed for quality VET (Shen et al., 2023), such cases are rare in the research literature (Fu & Weng, 2024).

The potential of GenAI to automate teachers' production of learning material etc. enables them to concentrate on instructional design and work-based professional development (Olivier & Weilbach, 2024). The apparent robust language comprehension and generation abilities of these data-driven AI technologies may lead to an instrumental practice and promote dependency and plagiarism, which in turn may weaken students' independent thinking abilities and teachers' agency in AI-integrated practices (Aagaard et al., 2024). In VET, an expanded version of AI literacy should be appropriated. Beyond a foundational understanding of AI concepts, it should include critical vigilance towards algorithmic and other biases in interacting with GenAi, due to the proximity of the key actors to emerging AI technologies without known ethical issues (Bekiaridis & Attwell, 2024).

In addition to the above potentials and challenges of GenAI for VET across subjects, VET teachers in each subject will integrate specific AI-powered platforms in their practices. With reference to our case from the vocational field of information technology and media (ITMP) students may learn Adobe Creative Cloud to improve their design skills. They could be introduced to AI coding assistants to make learning programming less tedious, using tools that provide real-time code suggestions and debugging assistance (Prieto et al., 2025). Also, other AI technologies are relevant for this field, for example, in game design (Zhan et al., 2022). Research that addresses such AI-powered learning is lacking in this field (Ranieri et al., 2025).

The proliferation of GenAI in educational contexts has stirred policy-oriented and research initiatives to develop frameworks for teachers' professional AI competences (Miaio & Cukurova, 2024). In a review and critical discussion of the early attempts in this direction, Mikeladze et al. (2024) underline the diverse nature of AI technologies and conclude that none of the identified types of frameworks convey this complexity in a meaningful way to teachers. Theoretical models in AIED are claimed to have gained too much weight in the formulation of the AI competencies frameworks for teachers. The authors propose a bottom-up strategy based on empirical studies of teaching practices involving a wide range of AI tools. A few attempts at adapting frameworks for general teachers' AI competencies to the VET sector (Bekiaridis & Attwell, 2024; Jemetz et al., 2025) do not add empirically validated dimensions to the list of AI supplements, namely expanded data literacy, computational thinking, ethics and technical skills.

In line with the proposal of Mikeladze et al. (2024) and Filo and Mor (2024), we adopted a bottom-up strategy in our study when exploring the profile of VET teachers' AI competencies. However, our analytical template included categories from our systematic literature review and framework of VET teachers' professional digital competencies (Lahn & Berntsen, 2023). Technological integration that connects work and school, could be analysed at an interaction level, for example, in simulations (interactional connectivity) and at a more formalised curriculum level, for example, in instructional guidelines for project-based training (curricular connectivity, Tynjälä et al., 2022). We distinguish between "broad" professional digital competences and "deep" vocational digital competencies. In the present context, the first category is related to VET teachers' professional roles and general pedagogy adapted to VET, while the second category refers to technology-enhanced, subject-specific didactics in vocational education.

AI technologies may challenge this distinction when effective and responsible teaching put to the test teachers' agency in both professional roles and subject-specific didactics (Mouta et al., 2025). Faced with data-driven AI and disruptive forces, AI-exposed VET teachers need to iteratively redefine their role at the centre of teaching and learning and to co-create AI-integration for pedagogical purposes (Seufert et al., 2023). The fast pace of AI transformations may undermine the necessary collective learning and institutionalisation of innovative

teaching practices to develop technological integration at this level. In short, the digitalisation of VET in the AI era may problematise and actualise the revision of the model of VET teachers' professional digital competencies.

The above review of AI and VET teachers is influenced by our socio-material perspective on learning and training that underlines the co-constitution of individual cognition, social interaction, and performativity with artefacts understood as tools designed for human purposes (Säljö, 2019). In the AI era, this perspective needs to be expanded to take into account transformations at societal meso and meta levels (Gibson et al., 2023). As AI reshapes teaching by automating assessment and feedback, supporting personalised learning, and reconfiguring teachers' roles as facilitators, orchestrators, and co-learners (Gentile, 2023), these transformations impact teachers' professional identities and educational institutions (Lan, 2024) and should be understood in the wider socio-material dynamics of global digital platforms and infrastructures (Williamson et al., 2024). This complex ecology is a needed lens when studying VET teachers' AI competencies. Given this theoretical perspective and our review above, we formulated the following research questions for our study:

- *How does the use of AI in the ITMP programme impact the subject-specific didactical practices of vocational teachers?*

- *How does the use of AI in the ITMP programme impact the general didactical practices of vocational teachers?*

- *How does the use of AI in the ITMP programme transform the professional digital competencies of vocational teachers?*

3 Methods

Given the lack of research on VET and AI, this study has been explorative, aiming at a deeper understanding of how VET teachers in the ITMP programme integrate AI in their teaching. In order to obtain a rich understanding of VET teachers as AI pioneers in didactical strategies, we have oversampled teachers actively using AI and innovative practices. This was achieved by selecting ITMP teachers in two schools as cases of AI pioneers. The ITMP programmes in these schools are sub-cases of a single setting case – a network of schools and companies in the ITMP field.

Consistent with the design of multiple case studies (Stake, 2013) data was obtained using multiple methods: (1) Personal interviews with teachers in the two schools (N= 5), transcribed, (2) researchers' field notes from observations in the schools, (3) researchers' field notes from two network meetings, and (4) the collection of documentary data (lesson plans,

presentations from teachers and companies in the two network meetings. The interview and observation guides were informed by previous research on AI-integrated teaching and VET teachers' professional digital competences (Lahn & Berntsen, 2023). They were structured around three main categories: (1) Subject-specific use of AI, (2) VET teachers' professional roles and general pedagogy adapted to AI in VET, and (3) the professional development of pioneering teachers.

The data material was organised to facilitate integrative analyses of the different datasets (Bazeley, 2018) related to the three research questions. An initial identification of interesting patterns in the material was followed by tentative coding based on the categories reviewed above. These codes were then grouped into potential themes by looking for patterns and underlying concepts that connected different codes to the research questions, for example, as suggested explanations for innovative AI practices in terms of subject-specific digital competencies. The final stage in our use of abductive thematic analysis (Thompson, 2022) involved a review of the thematic structures across different datasets (and data-collection methods), as triangulation of consistent and inconsistent findings (Kuorikoski & Marchionni, 2016).

In the analysis of the interview data, ChatGPT (OpenAI, GPT-4) was used as a complementary analytical tool alongside manual thematic analysis (Yang & Ma, 2025). The tool supported the identification of patterns and relationships in the material and offered alternative ways of grouping codes and themes. Specifically, we formulated precise prompts asking the model to code or summarise interview excerpts according to categories that emerged from the manual analysis (general didactical use of AI, vocational-didactical use of AI, and teachers' professional development in AI). In a later phase, ChatGPT was used more inductively to identify new themes or patterns in the data based on the interview texts and the article's research question.

To reduce the risk of biased or fabricated responses ("hallucinations"), we iteratively refined our prompts in dialogue with the manual analysis. The thematic patterns derived from the two approaches were largely in agreement, but ChatGPT also helped identify additional relationships, such as links between teachers' use of AI and students' sense of mastery, that were subsequently examined through closer manual analysis. Although the automated procedure could not provide contextual or theoretical interpretations, the iterative prompting process made our coding criteria and analytical decisions more explicit.

Overall, the use of ChatGPT served as a reflexive support in the qualitative analysis rather than as a replacement for researchers' interpretation, providing alternative patterns against which we could test and interrogate our own expert judgement (Thompson, 2022). Similar approaches have been reported by Siiman et al. (2023) and Yang and Ma (2025). A description of the prompts and analytical procedures is provided in a separate appendix ("AI appendix"; see table 1), offering transparency regarding how ChatGPT was applied in the study.

In our analysis, we made a distinction between data that referred to AI practices and data that referred to the participants' views on the use of AI and VET teachers' professional digital competencies. A major purpose of this study on the ITMP program has been not only to address the formulated research questions but also to establish a foundation for planned 'replications' in the vocational fields of health and construction/technology, based on its research design and empirical findings.

4 Results

Our presentation of the results is guided by the research questions and the three related main themes produced by our analyses.

4.1 Vocational Didactic Use of AI

Two subthemes stand out in this section: *AI as an integrated part of students' vocational competence in the ITMP programme, and Ethical aspects of vocational didactic use of AI.*

AI as An Integrated Part of Students' Vocational Competence in the ITMP Programme
Teachers in the ITMP programme view AI use as a natural extension of the vocational competence students must acquire for their future professions. As one teacher (1_4) put it, "As an IT and media program, we have no choice, because students will work with this in one way or another". AI is already embedded in industry-standard software such as Adobe Photoshop, enabling automation of time-consuming tasks like expanding image boundaries or removing unwanted elements through prompting.

In programming education, students use AI to detect coding errors and generate functional code. The teachers observed that while AI reduces the need for memorising code syntax, students must still understand the underlying logic of programming to apply AI-generated solutions effectively. Students are also encouraged to experiment with AI to develop entire programmes based on their own specifications.

Hands-on experience remains a priority. For example, students developed a weather app using data from the Meteorological Institute, linking theoretical understanding to practical application. In media production, the teachers describe three principal uses of AI: Integration into tools like Photoshop, generating business concepts with language models such as ChatGPT, and producing images using AI-based image generators. Adobe Creative Cloud programmes, which incorporate AI into tasks concerning audio, image, and graphic design, are central to this work.

The teachers emphasised that AI significantly reduces manual effort and predicted that manual image editing will become rare and prestigious. Nevertheless, mastering AI use

requires foundational knowledge in areas like colour theory and lighting. Students' success with AI depends on their ability to craft precise prompts and understand the technological processes behind the outputs. One assignment, "Startup with AI", challenged students to create a business concept using AI tools. Students developed business ideas, generated names and concepts via ChatGPT, and produced marketing materials that met industry standards.

The teachers also reflected critically on the creative limitations of AI-generated images. Although outputs often look impressive, they may not fully align with students' visions, requiring persistence and critical engagement. The teachers encouraged students to experiment practically while deepening their theoretical understanding of AI technologies.

Ethical Aspects of Vocational Didactic Use of AI

Initially, scepticism surrounded AI use in IT operations, particularly regarding privacy and GDPR concerns. In response, the teachers emphasised responsible AI use, such as creating anonymous email accounts and discussing the ethical implications of AI-generated content. Some schools have secured public AI licences to protect student privacy, but these are often technically inferior to commercial licences. Consequently, some students use privately funded licences, creating an ethical dilemma: Access to superior tools becomes dependent on parental resources, and privacy protections are weaker for paid licences. The teachers acknowledge this inequity but continue to allow different licence types in practice.

4.2 General Didactic Use of AI

Two subthemes stand out in this section: AI as an assistant teacher and AI for adapted training.

AI as an Assistant Teacher

The teachers used AI actively throughout lesson planning, classroom work, and assessment. In planning, AI acted as a sparring partner, assisting teachers with generating assignment ideas, structuring tasks, and providing feedback on teaching materials. The teachers often fed AI background information, desired elements, and assessment criteria, and received structured assignments and updated resource suggestions, such as relevant YouTube videos. AI's ability to create clear assignment structures was particularly valued for supporting student understanding.

During lessons, AI functioned as a "private tutor" for students, providing immediate assistance while teachers attended to other students. The teachers observed that AI support increased students' help-seeking behaviour, enabled quicker task progression, and reduced waiting times. Thus, one teacher described AI as an "assistant on speed" (1_12). Students often used AI for minor technical issues like code debugging, freeing teachers to focus on fostering deeper system-level understanding and mentorship.

The teachers emphasised that AI contributed to more efficient training sessions, enhancing students' sense of mastery. Several teachers noted that early mastery experiences encouraged students to take on more complex challenges, such as API development as early as in the first year of study. One teacher stated, "We couldn't have done this a few years ago without the help of AI" (2_22).

The teachers stressed that AI use necessitated changes in assessment practices, with a greater focus on process-oriented evaluation. To ensure genuine learning rather than blind copying, the teachers designed tasks where students had to document their use of AI, explain problem-solving strategies, and reflect on their learning process. Thus, AI as an assistant teacher promoted self-regulated learning, critical digital literacy, timely feedback, and a shift from teacher-centred to student-driven learning processes.

AI for Adaptive Training

Through the use of AI, the teachers could facilitate differentiation related to both students' interests and level of qualifications. The teachers used AI to design various assignment options, allowing students to specialise in specific vocational qualifications. AI also allowed students to engage in tasks where teachers lacked direct vocational expertise, such as sound production in one school. In such cases, the teacher's role shifted from subject expert to learning coach, guiding students in resource exploration and decision-making aligned with their vocational goals. The teachers linked this approach to greater student motivation: "When the students are allowed to go in the direction they want" (2_48).

Furthermore, the teachers used AI to design assignments with varying levels of difficulty. Basic production tasks contained essential elements, while advanced tasks invited the inclusion of optional, more complex features. The teachers noted that this adaptive structure could increase the digital divide, as students with greater learning pressure tended to advance faster. However, they still concluded that all students benefited from the AI-supported adaptive structure.

Finally, the teachers pointed out that AI supported students with special educational needs, such as dyslexia, by reducing the emphasis on correct spelling and grammar. Overall, the findings suggest that AI-facilitated adaptive training empowered students to make informed choices about vocational specialisation and the difficulty level of their tasks, thereby fostering differentiated learning pathways and enhancing learning outcomes.

4.3 Vocational Teachers' Competence Development

The analyses show that innovative vocational teachers develop AI competence through personal motivation, informal learning contexts, active experimentation, and an evolving understanding of their pedagogical role. Four interconnected themes emerged: Self-efficacy,

attitudes and interest in engaging with AI; AI competence development as a private project in informal networks; early experimentation placing some teachers ahead of the industry; and the changing teacher role as a co-learning process.

Teachers' positive attitudes and technological familiarity were seen as crucial for keeping up with rapid developments and acting as early innovators of AI. Several teachers reported that they were accustomed to frequent technological shifts and regarded engagement with new technology as integral to their evolving professional identity. This exploration was often driven by strong personal interest and commitment rather than institutional structures.

Competence development largely depended on individual initiative. Several teachers described purchasing private AI licences to stay updated, reflecting both high personal motivation and dissatisfaction with the limited institutional support available for experimenting with emerging GenAI tools. The teachers emphasised the need for more formal support structures to appropriate the technology and develop sustainable AI competence.

Informal networks and private relationships with industry were important learning arenas. The teachers highlighted how contacts outside school provided quick updates on industry trends, though many expressed a desire for more formalised collaboration networks. While AI tools were useful for obtaining quick overviews of developments, the teachers also voiced concern about the ethical and factual reliability of AI-generated content, as well as the challenges of keeping pace with the rapid technological evolution. In some cases, especially within IT subjects, vocational teachers felt they had greater freedom and opportunity than industry to experiment with new technologies. Several noted that, in certain specific areas, they were ahead of industry practices.

The teachers reflected that teaching in a field undergoing rapid transformation required flexibility and a willingness to adopt an exploratory role. Students were generally receptive to this dynamic, accepting statements such as "Give me 15 minutes, and I'll figure it out" (1_18) as part of a mutual learning process. Developing confidence in using AI in teaching was often described as a form of co-learning with students. The teachers created assignments that allowed parallel learning, where both teacher and student engaged with new technologies together.

Finally, some teachers emphasised the importance of developing pedagogies that integrate soft skills and human judgement. They saw collaboration between humans and AI—mediated through natural language—as an emerging competence, requiring new approaches to vocational education.

5 Discussion

Our analyses, structured around three central themes—vocational didactic use of AI, general didactic use of AI, and vocational teachers' competence development in an AI era—confirm

previous studies of AI in VET (Olivier & Weilbach, 2024) when identifying the following major applications: (1) "Assistant teacher" in both lesson planning and design of assignments, and (2) coaching support for students in the execution of tasks, notably explanation of procedures, immediate feedback on completion of tasks and self-correction tips. However, our study of the ITMP programme reveals that the integration of AI into vocational training is not only perceived as a timely and supplementary task. The new vocational didactics are identified as essential in preparing students for contemporary and future industry demands. AI extends vocational competence by being embedded within the tools and practices students are expected to master. For example, AI-enhanced applications such as Adobe Photoshop and AI-driven code generation tools are incorporated into routine instruction. These tools enable automation of time-consuming tasks and provide real-time support for programming and media production, thereby generating more leeway for creative tasks and higher-order learning, such as the "Startup with AI" project. These activities were found to be connective at the interactional level with working life, which facilitated the linking of theoretical understanding and practical skills. Thus, entrepreneurial learning methods such as business development and problem-based learning traditionally associated with VET, may gain renewed momentum in response to AI. However, innovative practices were not clearly formalised at a curricular level, reflecting a certain institutional inertia in the face of rapid technological changes in schools and work.

The VET teachers in the ITMP programme emphasised that the successful use of AI was dependent on subject-specific knowledge and the ability to convert such understanding into precise prompts and critical interpretations of AI output. The students were informed about ethical concerns, but also encouraged to actively experiment with anonymisation practices and procedures to reveal production biases and illegitimate use. A notable disparity arose from students' differential access to high-quality AI tools, since those who could afford privately funded licences often gain access to more powerful AI functionalities. This tension points to the urgent need for institutional policies and resources that ensure equitable access to the new technology.

Furthermore, AI supports adaptive learning by allowing students to customise tasks based on their interests and skill levels. This personalisation enhances student motivation and engagement, particularly when learners are allowed to specialise in vocational areas aligned with their aspirations. The teachers also noted that AI accommodates students with special educational needs, such as dyslexia, by reducing the emphasis on linguistic accuracy and providing alternative avenues for expression and comprehension. Nonetheless, the increased potential for individualisation carries the risk that students with stronger learning conditions may progress more quickly, potentially widening the digital divide. Despite this, the overall benefits of AI-supported differentiation, particularly in fostering learner autonomy and vocational relevance, are significant.

AI is also transforming general pedagogical practices of vocational teachers. Our analyses show, in line with previous studies (Olivier & Weilbach, 2024), that AI is mainly used as a "teaching assistant" in both lesson planning and task design, as well as in providing guidance support for students during work. The teachers used AI to explain procedures, provide immediate feedback, and suggest self-correction strategies, which were highlighted as important support for student learning progress, particularly by facilitating tailored and individualised tasks. The study thus confirms that AI can support differentiated instruction, as also emphasised by Pozdniakov et al. (2024).

The study also showed that teachers rarely explicitly reflected on how AI could promote critical thinking, even though some students received instruction in ethical issues such as privacy and algorithmic bias. When it came to handling ethical dilemmas in practice, teachers balanced ideals of privacy with the desire to ensure the best possible learning outcomes, often in a pragmatic manner. Ethical reflection was present but not always aligned with idealised frameworks, suggesting a need for stronger integration of ethics and critical thinking in vocational teachers' professional digital competence, as also called for by Lahn and Berntsen (2023) as an area for further research.

The findings also illustrate a shift in the teacher-student dynamic. Teachers are becoming less like traditional experts and are increasingly adopting the role of co-learners, modelling adaptability and transparency as they explore unfamiliar technologies alongside their students. This reciprocal learning environment not only fosters a culture of mutual respect but also prepares students for the collaborative and exploratory nature of modern workplaces.

Our third research question addressed how the use of AI is transforming vocational teachers' professional digital competencies. Although the teachers in the study did not explicitly describe these new requirements, the study highlights the central role of teachers' agency in developing their own AI competencies. This process included learning through informal networks, personal experimentation and self-directed learning across the work-school boundaries. It reflected a broader professional ethos (Lahn & Berntsen, 2023) in which teachers saw themselves as lifelong learners and innovators. Some of the VET teachers reported being ahead of industry practices in their experimentation with generative AI tools, leveraging their instructional freedom to explore new technologies without commercial constraints. On the other hand, institutional support in developing relevant AI skills was called for.

Our analyses indicate that the development of AI-mediated teaching requires additional competencies that are not necessarily included in early piloted frameworks (Bekiaridis & Attwell, 2024; Jemetz et al., 2025). Our sample of vocational teachers was not explicit about the need for AI competence and algorithmic thinking—possibly because they perceived these aspects as already embedded in the curriculum for the ITMP programme. However,a very distinctive feature of our study was the strong emphasis on competence development, which partly reflects a mismatch between the necessity of keeping up with advanced technological

expertise and the absence of organised arrangements for AI competence development. A recurrent pattern was the private and practice-based character of such activities that combined a need for updated technological skills and a strong interest in such competence development. Several of our vocational teachers emphasised, on one hand, the challenges and opportunities of co-learning AI with students, updating themselves by interacting with industry and professional networks and on the other hand, a lack of resources for trying out the new technologies. We understand these statements as reflecting a felt need to go beyond mere instrumental mastery and to take part in more formalised processes that would strengthen their competencies in vocational didactics with AI and improve their teaching in ethical and critical use of such technologies—and we could add AI literacy.

6 Concluding Remarks

A conceptual basis for this study was a distinction between general and specific professional AI digital competences for vocational teachers. Our explorations of "AI pioneers", that is vocational teachers in the Norwegian ITMP programme, and their integration of AI in their teaching provide grounds to expect some general patterns for AI pedagogy across vocational subjects. These include assistance in the production of learning resources, guidance and formative assessment that reduce time spent on routine tasks, as well as enabling project-based teaching, orchestration of differentiated learning trajectories, and the development of students' AI literacy and ethical reflection

The specific competencies identified in our study reflect the strong exposure the selected VET programme has had to AI transformations, which challenged vocational teachers to stay up to date with technological innovations, possibly at the expense of developing more specific AI didactics tailored to VET. These concluding reflections on our study provide possible directions for further research on the issues at hand. Our provisional claims about expected general AI pedagogy for VET should be validated in a comparative study of vocational fields that are less exposed to AI than the ITMP programme. In our study, we have accepted that the "AI pioneers" are a positive sample in terms of technology acceptance, digital competence etc., which is a key concern when interpreting the results.

Still, it is reasonable to expect in other vocational programmes a similar engagement in self-initiated competence development and a discontent with institutional support reflecting the spirit of time marked by rapid AI innovation A slowdown would provide leeway for collaborative didactical innovations and the institutionalisation of an infrastructure for an AI pedagogy for VET. It may support curricular connectivity between work and school. However, disruptiveness may prove to be a more or less permanent condition. In order to understand this changing ecology, comparative, longitudinal studies should be undertaken across vocational fields and international VET systems.

Ethics Statement

This study adhered to the research ethics regulations of the two universities and the Norwegian Agency for Shared Services in Education and Research (SIKT). The participants received appropriate information on privacy and data protection and gave informed consent in accordance with SIKT's guidelines. The authors report that there are no competing interests to declare.

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Biographical Notes

Svanhild Kristine Berntsen is an Associate Professor at the Department of Vocational Teacher Education at Oslo Metropolitan University. She teaches in the Practical Pedagogical Education Programme for Vocational Subjects (PPUY) and in the Professional Development Programme Digital Tools and Personalised Learning in Vocational Education (DTK), where the use of artificial intelligence (AI) is receiving increased attention. Her research interests focus on technology-enhanced teaching and learning in Vocational Education and Training (VET).

Øyvind Granborg is a University Lecturer at the Department of Vocational Teacher Education at Oslo Metropolitan University. He teaches in the Practical Pedagogical Education Programme for Vocational Subjects (PPUY). His research interests include collaboration between universities and schools, media didactics and the use of AI in VET.

Steinar Karstensen is an Associate Professor at Oslo Metropolitan University, where he works in vocational teacher education with a focus on digitalisation and the didactical use of AI. His research addresses how AI transforms vocational didactics, teacher competence, and learning environments. Karstensen has contributed to national development projects on virtual tools and AI in education and has published extensively on the intersection of technology and vocational training. He is involved in research collaborations on AI pedagogy and professional learning across school and workplace contexts.

Leif Chr. Lahn is an Adjunct Professor at the Department of Vocational Teacher Education at Oslo Metropolitan University and a Professor Emeritus at the Department of Education, University of Oslo. Principal investigator of several national/international projects related to vocational didactics and digital learning resources in a working life setting. Visiting professor at Stanford University, CA (2007-2008) on technology enhanced learning design. His main research interests are in the digitalization of workplace learning and professional expertise, notable advanced systems such as expert systems and AI-platforms.

Nina Aakernes is an Associate Professor at the Department of Vocational Teacher Education at Oslo Metropolitan University, where she primarily teaches in the master's programme in vocational pedagogy. Her research interests lie within a broad field, with particular emphasis on how digitalisation and rapid technological change affect vocational education and training (VET); collaboration between universities, schools, and the world of work; and educational reforms in VET. Her current research focuses primarily on using AI in vocational education as part of professional practice and within vocational work contexts.

Appendix

Table 1: AI Appendix – Description of the Prompts and Analytical Procedures

Stage	*Purpose*	*Prompt example (to ChatGPT) and analytical work*	*Type of analysis*	*Main output / example response from ChatGPT*	*Researcher interpretation and use*
1. Deductive coding	Test AI's ability to apply existing manual categories	"Can you code the following interview excerpts according to these categories: (1) use of AI in task design, (2) use of AI in assessing vocational competence, (3) use of AI for teaching students about AI, (4) use of AI to address ethical challenges, (5) use of AI for collaboration with industry?"	Deductive, category-driven	ChatGPT summarised text under the five categories. Example: "*Teachers use AI to generate tasks of varying difficulty and adapt them to different contexts.*"	Confirmed main manual categories; helped validate coding consistency. Highlighted overlapping use of AI for assessment and teaching support.
2. Exploratory pattern detection	Identify additional or overlooked categories	"Based on the following interview excerpts, can you identify possible categories or themes related to how teachers integrate AI in vocational education?"	Inductive, open-ended	Suggested eight new categories: *pedagogical approaches, innovation and creativity, technical skills, student motivation, practical projects, feedback and reflection, inclusion, collaboration.*	Several new categories overlapped with manual subthemes but added nuance — particularly *innovation* and *collaboration*. Researchers compared and integrated these into the thematic structure.
3. Abstract-level synthesis	Generate higher-order thematic patterns base d on the abstract and research question	"Please analyse the following interview excerpts based on the study's abstract and identify 3–5 main themes that capture how AI transforms vocational teachers' didactical practices and professional digital competence."	Thematic synthesis (abductive)	ChatGPT proposed four abstract themes: *(1) AI as an integral part of teaching practice, (2) Didactical approaches and students' sense of mastery, (3) AI as a tool for creativity and innovation, (4) AI's influence on teachers' professional development.*	The AI themes aligned strongly with manual analysis but linked teacher and student perspectives more explicitly (e.g., mastery and motivation). Researchers incorporated this link into the final thematic framework.
4. Reflexive comparison	Compare manual vs. AI-generated structures	Comparison of the manually derived categories (general didactical use, vocational didactical use, professional development) with the AI-generated themes. Which similarities and differences emerges?	Comparative, reflective	ChatGPT highlighted conceptual overlap between general didactics and *AI as integral to teaching, and between professional development and AI's influence on teachers.*	Confirmed thematic robustness. Encouraged clearer articulation of how AI functions both as content and pedagogical tool.
5. Quality assurance of accurate results	Test for bias and hallucination risk	Summary of what is explicitly stated in the text.	Validation	ChatGPT provided concise, text-bound coding results; removed speculative statements.	Ensured analytic reliability and transparency.