A Practical AI Readiness Framework for Career and Technical Education

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Abstract
The rapid integration of artificial intelligence in workplaces is transforming work-related activities and creating a pressing need for Career and Technical Education (CTE) curricula that prepare students to work in AI-infused environments. Nevertheless, guidelines that only teach students how to use generative AI systems do not provide comprehensive workforce training. This research paper proposes the AI Readiness Framework based on five dimensions, including: (1) AI Literacy, (2) Applied AI Skills, (3) Human-AI Collaboration and Judgment, (4) Responsible and Ethical Use of AI, and (5) Adaptability and Continuous Learning. This framework emphasizes moving from basic AI literacy to proficiency in skills tailored to specific career paths. Adopting this framework will ensure CTE graduates can use, evaluate, and adapt AI technologies in their careers.

Introduction

Integrating AI into professional environments represents a significant change in how many tasks are done. AI technologies such as generative AI, machine learning, predictive analytics, automation, and intelligent decision-making systems support tasks like writing, programming, data analysis, customer service, research, and decision-making. Evidence suggests that AI impacts should not be viewed strictly as job replacement but as changes to individual tasks and how humans combine technological capabilities with their own skills and judgment (Dell'Acqua et al., 2023; Eloundou et al., 2024; Noy & Zhang, 2023).

Experimental studies demonstrate positive impacts of AI on human performance. For example, Noy and Zhang (2023) found that professionals with access to generative AI could complete the same set of writing tasks faster and achieve better results than participants without AI. However, AI's advantages are not universal; they apply to some tasks but not others. Dell'Acqua et al. (2023) describe a "jagged technological frontier," where AI makes some tasks very easy but performs other tasks poorly, which users perceive as equally complex. Therefore, using AI requires not only typing prompts into the application but also identifying situations where AI is advantageous, assessing AI output, understanding its limitations, and exercising professional judgment when AI recommendations are unreliable (Dell'Acqua et al., 2023, 2026; Noy & Zhang, 2023).

Career and Technical Education (CTE) relates closely to this problem because one of its main purposes is preparing learners to perform authentic occupational tasks. As AI becomes integrated into professional workflows, CTE programs will need to teach students how to assess and work with AI technologies in specific occupational environments. Existing research on AI literacy already provides some theoretical foundations. In their study, Long and Magerko (2020) defined AI literacy as a set of competencies that allow humans to critically assess AI technologies, interact and cooperate with them, and use them as tools. Further research also agrees that AI literacy means

not only the technical operation of AI but also conceptual understanding, practical application, critical assessment, and ethical consideration (Ng et al., 2021).

Based on the available literature on AI literacy, this paper proposes a practical AI Readiness Framework for CTE with five connected dimensions: AI literacy, applied AI skills, human-AI collaboration and judgment, responsible and ethical use of AI, and adaptability and continuous learning (Long & Magerko, 2020; Ng et al., 2021; Rupnik & Avsec, 2025). This framework is a practical synthesis for CTE, not an already validated model. The main question for this framework is: What competencies should CTE students develop to become ready for an AI-augmented workplace?

The Changing Workplace and the Need for AI Readiness

AI and the Changing Nature of Work

Artificial intelligence (AI) is reshaping how work is done across occupational sectors, from business and information technology to health care, manufacturing, marketing, data analysis, and administrative services. The key difference is that these technologies generally affect individual actions within occupations rather than eliminating entire occupations (Eloundou et al., 2024). As a result, workers may find themselves in occupations that involve activities that can be automated and/or sped up using AI, while other activities remain highly human-dependent.

Recent experiments support this notion. In particular, Noy and Zhang (2023) studied the effect of generative AI on professional writing and found that using generative AI significantly increased speed and quality. For knowledge workers, generative AI can improve performance on tasks within the AI's capacities, whereas the same technology can reduce performance on tasks beyond its capacity (Dell'Acqua et al., 2023). Thus, learning to operate an AI tool does not imply being able to work in an AI-augmented occupation. Such findings have significant educational consequences. First, students need to know not just what AI can do, but also when its limitations matter professionally. Second, learning should involve viewing AI as a collaborative process between humans and machines.

From AI Literacy to AI Readiness

AI literacy provides the foundation for AI readiness. According to Long and Magerko (2020), AI literacy is viewed as a set of skills that allows one to analyze AI technologies, communicate and collaborate with AI, and use AI as a tool in a variety of contexts. These skills include AI recognition, machine intelligence, data interpretation, identifying strengths and weaknesses, and ethical consideration. Moreover, Ng et al. (2021) offer another perspective on AI literacy and introduce the notion of multi-dimensional AI literacy, including knowing/understanding, using/applying, evaluating/creating, and considering ethics regarding AI. These perspectives show that a person's ability to be AI-literate is more complex than mere knowledge of a particular application (Ng et al., 2021; Tadimalla & Maher, 2025).

In career and technical education (CTE), however, workforce preparation demands an occupational dimension. Thus, although a learner can use AI to generate text, images, code, and recommendations, they may not have the skills to check whether the results meet professional requirements. Therefore, in this paper, AI readiness refers to the broader ability to apply AI literacy

in an occupational context. In this way, an AI-ready student should be able to understand an AI system as required for the task, use it properly, check its results, decide when human interaction is needed, detect ethical issues and privacy concerns, and apply these skills to developing technologies (Bouguettaya et al., 2025; Rupnik & Avsec, 2025).

A Practical AI Readiness Framework for CTE

This framework consists of five related dimensions. These dimensions draw on themes from AI-literacy literature, research on human-AI cooperation, and emerging evidence on applying generative AI within professions. The framework is designed to apply to occupations and adapt to various CTE programs.

Dimension 1: AI Literacy

Basic AI literacy for students involves understanding AI, knowing how typical AI systems work at an appropriate conceptual level, and understanding their capabilities and limitations. According to Long and Magerko (2020), these basics include recognizing AI, knowing different types of intelligence, understanding machine learning, and evaluating the strengths and limitations of AI systems. Also, according to Ng et al. (2021), one dimension of AI literacy is knowledge and understanding of AI. Research on AI literacy education similarly emphasizes conceptual understanding, interaction and collaboration with AI, critical data literacy, and AI ethics (Yim & Su, 2025)**.** These skills and knowledge give students the background needed to understand AI and evaluate its capabilities.

The basic AI literacy dimension for CTE students does not require advanced knowledge of computer science or the mathematical calculations used in machine learning. Instead, students must have enough knowledge to evaluate AI use in a professional field. This includes understanding terms like generative AI, machine learning, training data, automation, predictive systems, and that AI-generated outputs may be inaccurate or misleading (Bouguettaya et al., 2025; Rupnik & Avsec, 2025).

Dimension 2: Applied AI Skills

AI knowledge becomes relevant to the profession when learners can apply it in real professional situations. Therefore, Applied AI instruction should be embedded within the occupational context of each CTE program. For example, business learners might use AI to process market information and draft first versions of business communications. IT learners could use AI tools to help them write code, document it, and troubleshoot problems. Learners in healthcare could use AI information with an emphasis on the importance of clinical supervision. Manufacturing learners could consider AI for predictive maintenance and quality control. This approach fits into a broader understanding of AI literacy, which involves not only knowledge but also application (Ng et al., 2021). This approach is also supported by findings suggesting that generative AI can improve professionals' performance on specific tasks when properly integrated into human workflows (Noy & Zhang, 2023).

The goal is not to make students proficient in any particular commercial product since AI technologies will change, but to teach students a transferable process of identifying the problem at hand, evaluating the use of AI to address it, choosing and employing a proper system, evaluating the result, revising or discarding it, and documenting or communicating the decisions made.

Dimension 3: Human-AI Collaboration and Judgment

Human-AI collaboration and professional judgment are critical aspects of AI readiness because AI performs unevenly across tasks. Dell'Acqua et al. (2023) call this a "jagged technological frontier." In their research involving knowledge workers, those who used AI had a higher success rate on tasks within the technology's capabilities, while using AI for tasks beyond that frontier led participants to draw false conclusions. This has great educational value because using AI requires distinguishing between using, questioning, verifying, and rejecting AI output (Dell'Acqua et al., 2023). In that case, learners ought to be encouraged to ask the following questions: Should I use AI in this case? What kind of information is needed to verify the recommendation? What skills do humans contribute? What are the consequences of incorrect AI-generated output? Who is responsible for the decision in the end?

Accordingly, human-AI collaboration should not be a one-shot exercise but a series of prompts and responses. Learners may seek another explanation from AI, recognize assumptions, seek counterarguments, compare with expert evidence, and refine their reasoning based on the AI output. It is important not to maximize AI usage but to use AI appropriately alongside human judgment (Dell'Acqua et al., 2023; Liel & Zalmanson, 2025).

Dimension 4: Responsible and Ethical AI Use

Technical expertise alone does not determine whether to apply AI in professional practice. Students also need to consider the ethical, legal, organizational, and social aspects of AI use. Ethics is a cornerstone of AI-literacy frameworks. Long and Magerko (2020) include ethical awareness as an element of AI literacy, while Ng et al. (2021) view ethics as a key dimension of understanding and using AI. Therefore, AI readiness goes beyond the skills needed to operate an AI system. It involves students developing the judgment to ensure that their use of AI is responsible and appropriate.

Ethical instruction in AI in career and technical education (CTE) programs should connect to concrete workplace scenarios and not be discussed only as theoretical concepts. Depending on their occupational field, students may face issues related to personal data, confidential business data, intellectual property rights, algorithmic bias, misinformation, transparency, safety, and accountability (Bouguettaya et al., 2025; Surbakti, 2025). For example, they need to understand that entering confidential information into an AI system not approved for such data creates significant risks. In addition, students need to be aware that although AI-generated content can look convincing and professional, it may contain incomplete, biased, or incorrect information. Developing this skill is especially relevant to CTE, as students will apply technology in environments where mistakes can harm customers, patients, organizations, colleagues, or the public.

Therefore, responsible AI instruction should focus on evaluating both the capabilities and consequences of AI use. When using AI, students should consider what information they provide to the system, whether it is appropriate for the task, how to verify the output, and who is accountable for the final decision (Bouguettaya et al., 2025; Surbakti, 2025). In this way, human judgment becomes central to AI readiness, rather than ethical AI use being a separate concept.

Therefore, students should routinely ask not only, "Can AI do this?" but also, "Should AI be used in this way, under these circumstances, with this information?"

Dimension 5: Adaptability and Continuous Learning

The last dimension relates to the increasing pace of technology development and the need for students to adapt in their professional development. No CTE program can fully prepare students by providing the necessary knowledge of all the AI products, platforms, and applications they may encounter in their careers, given the constant changes in technologies, interfaces, models, and organizational policies. Moreover, knowledge gained through training and specific product use can become obsolete once new technologies emerge and requirements change. In this way, it is better to focus on adaptability than on specific technologies (Henukh et al., 2025; Rupnik & Avsec, 2025).

Students should learn to work with new AI tools, transfer previous experience to new technologies, learn independently, adapt workflows, and continually improve their professional knowledge and skills. Adaptability should include critical thinking, because the presence of a new technology does not necessarily mean that it is more efficient, accurate, ethical, or appropriate, or applicable to the workplace task. Students should be ready to analyze the technology's opportunities and limitations, compare it with other alternatives, and decide whether it makes sense to use it in the professional workflow. In this way, continuous learning becomes part of AI readiness, because workers should be able not only to master new technologies but also to improve their professional knowledge in response to changing requirements (Henukh et al., 2025; Rupnik & Avsec, 2025).

AI literacy provides a foundation for adaptability. Long and Magerko (2020) define AI literacy as a set of skills and competencies that help people understand, interact, and evaluate AI technologies, while Ng et al. (2021) define AI literacy as a set of knowledge that includes understanding, applying, evaluating, and using AI ethically. Competency is more transferable than knowledge of one technology because it is based on understanding and evaluating AI rather than on the mechanics of a particular product. Thus, for CTE, adaptability means preparing students not only to work with available AI technologies but also to face continuously changing technologies and tools in the future.

Translating the Framework into CTE Teaching Practice

Developing AI readiness does not necessarily require an independent AI course. In numerous CTE programs, these competencies can be embedded into existing occupational tasks. The key instructional strategy is to embed AI within an authentic occupational task while keeping students responsible for analyzing AI-produced information and producing an artifact (Bouguettaya et al., 2025; Fu et al., 2025; Rupnik & Avsec, 2025). The proposed approach will let students experience AI as part of their professional activity while emphasizing the importance of human control over that process.

For example, in business decision-making, AI can produce several alternatives, but students will choose and justify one option, allowing them to develop human-AI judgment. Similarly, in data analysis tasks, AI can generate interpretations or explanations that students then verify against the original dataset. In customer communication activities, students can revise an AI-generated

response for accuracy, appropriateness, compliance with organizational policies, and professionalism (Bouguettaya et al., 2025; Rupnik & Avsec, 2025).

The same strategy can also apply to solving technical problems or addressing workplace ethics issues. For example, in the former case, students can verify AI-generated recommendations for addressing a particular technical problem and decide whether they work (Lin et al., 2025). In the latter case, AI can suggest actions that manipulate sensitive information, and students have to check for privacy, bias, security, or accountability issues (Alfiras et al., 2025; Lin et al., 2025). In general, such strategies can help students see AI not only as an answer-producer but also as an object of analysis.

Instructional Approaches

Several instructional approaches follow directly from the proposed framework.

- Comparisons in the context of AI include doing some tasks on their own first and then performing the same task while using the assistance of AI and making comparisons between these two different approaches. The student needs to determine whether applying AI technology improved, worsened, or changed task performance (Dell'Acqua et al., 2023).
- AI verification activities require students to evaluate AI-generated information against reliable sources, computations, technical guidelines, and professional knowledge. Generative systems may provide false information; therefore, treat verification as an occupation-based skill rather than an academic assignment (Bouguettaya et al., 2025).
- Human-AI decision-making includes providing students with professional problems along with a recommended solution suggested by an AI system. Students examine the situation and explain their reasons for their decision (Dell'Acqua et al., 2023).
- Ethics-related assignments require students to evaluate situations related to ethical issues such as privacy, bias, intellectual property rights, misinformation, transparency, and accountability. Students will be able to apply aspects of AI literacy ethics as discussed in the literature (Long & Magerko, 2020; Ng et al., 2021).
- Industry-based AI projects include giving students an occupation-related task, analyzing its relation to AI, and developing a human-AI interaction related to it. Consider both the advantages and limitations of the process.

Assessing Student AI Readiness

Assessment must go beyond whether the student can use the AI interface, because a student can generate output but not know whether it is correct, ethical, secure, and professionally responsible (Rupnik & Avsec, 2025; Tadimalla & Maher, 2025). A rubric for CTE assessment that is practical should involve evaluation of students at four proficiency levels - Emerging, Developing, Proficient, and AI-Ready across five dimensions. AI literacy would assess whether students understand the capabilities and limitations of AI technologies, while applied AI skills would evaluate their ability to incorporate AI into real-world, job-related activities. The Human-AI collaboration and judgment dimension would assess whether students critically reflect on AI-generated recommendations and know when to intervene (Rupnik & Avsec, 2025).

Responsible and ethical AI use can help assess students' awareness of potential problems related to accuracy, privacy, bias, intellectual property, security, transparency, and accountability, while adaptability can help instructors assess students' ability to apply their AI knowledge in different contexts. Assessments should measure not only output but also students' reasoning processes.

Instructors can ask students to explain why they chose to use AI, how they verified the output, what changes they made, what limitations they noticed, and why they accepted or rejected certain recommendations. These practices align more closely with the multidimensional AI literacy concept in the research literature (Long & Magerko, 2020; Ng et al., 2021).

Implications for CTE Educators and Programs

AI readiness should be embedded across CTE curricula rather than limited to a single course or lesson focused on generative AI. CTE programs could start by aligning the five dimensions with occupational competencies and identifying tasks where AI already impacts professional practice (Ismail & Mupita, 2025). Collaboration with employers and advisory committees is also needed to understand how AI is applied in local industries. Different types of applications will emerge in healthcare, IT, manufacturing, business, construction, transportation, and other CTE fields. Thus, the same set of AI-readiness competencies will translate into different teaching practices in each discipline (Rupnik & Avsec, 2025).

In-service training is also essential for teachers. They must have a chance to work with AI systems, learn about their capabilities and limitations, find occupation-specific AI applications, and form an appropriate classroom policy (Ismail & Mupita, 2025). Educators do not need to become AI engineers; however, they should know enough to design learning experiences that promote critical engagement with the technology. CTE programs should not focus their curriculum on specific products either. Training in how to operate today's most popular AI system risks developing skills that will become irrelevant as the technology evolves. Instead, it is better to teach students to define problems, test AI solutions, verify information, make decisions, protect privacy, and update their knowledge as new technologies emerge (Rupnik & Avsec, 2025).

Conclusion

Preparing students to work in an AI-augmented workforce goes beyond just teaching students how to use a generative AI application. Literature on AI literacy shows that competency involves understanding AI, using it, critically evaluating it, and identifying its ethical implications (Long & Magerko, 2020; Ng et al., 2021). Literature on workplace applications indicates that generative AI can enhance human performance in certain tasks but also poses risks when people use it beyond the technology's capabilities (Dell'Acqua et al., 2023; Noy & Zhang, 2023). Together, these findings support a broader framework for preparing students for the AI-augmented workplace. The five dimensions outlined in the AI Readiness Framework in this paper offer a broad approach to preparing students for future work.

In CTE, the focus should not be on educating students who can only use current AI tools. Instead, the emphasis should be on preparing professionals who can determine the need for AI and integrate it into occupational practice, critically evaluate the output of such applications, understand the risks and ethics of AI use, exercise independent judgment, and adapt as technology evolves. Such an approach will preserve the main attribute of Career and Technical Education: learning through occupational practice. Now, that practice will also include determining not only how to use technology but when to trust it, when to question its validity, and when human professional judgment should prevail.

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