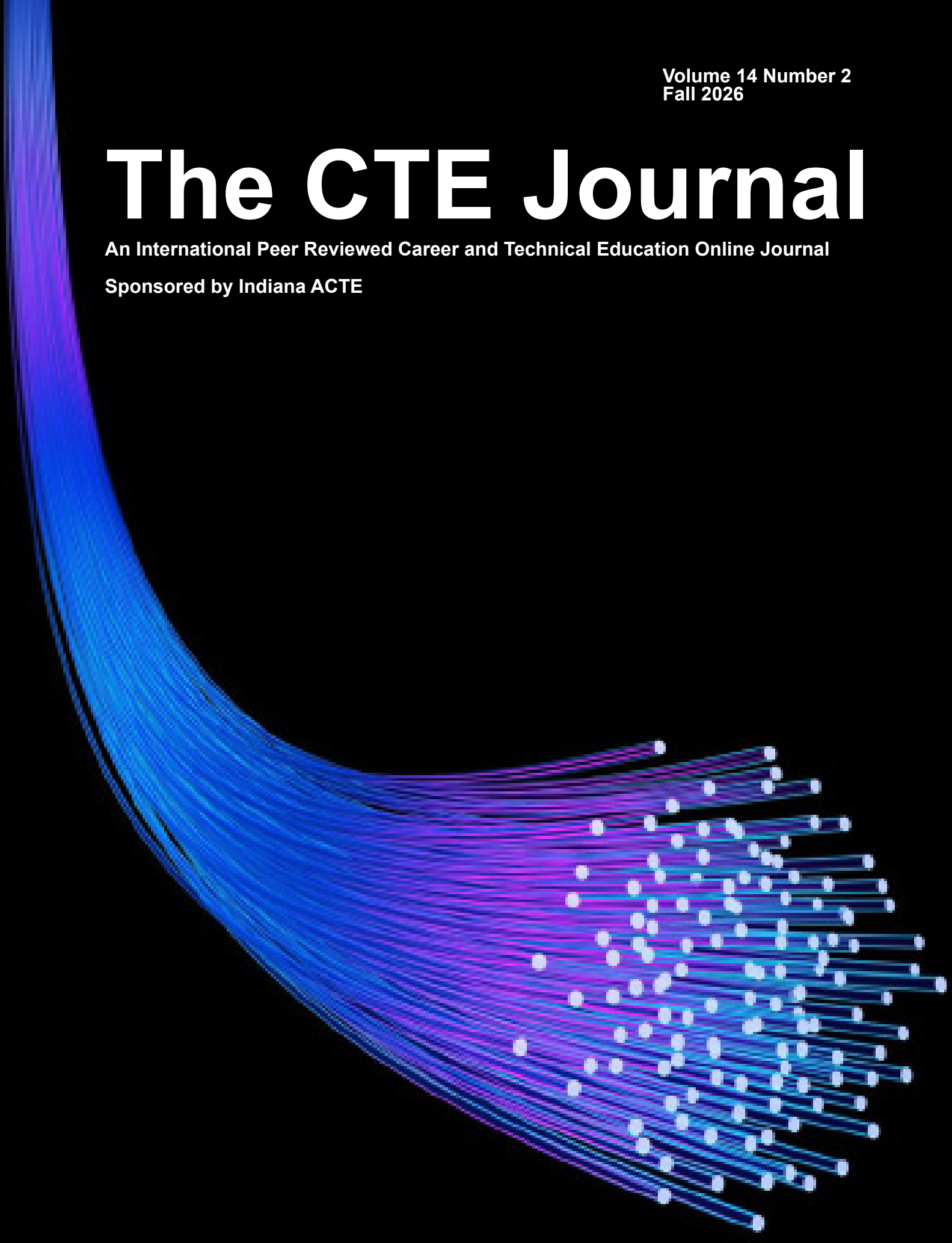
Volume 14 Number 2
Fall 2026

The CTE Journal

An International Peer Reviewed Career and Technical Education Online Journal

Sponsored by Indiana ACTE



ISSN 2327-0160 (Online)
Volume 14. Number 2.

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AI Integration and Career Readiness: Technology Professionals' Perspectives

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Abstract
As Artificial Intelligence (AI) continues to revolutionize the way we work, many Information Technology (IT) professionals find themselves navigating an unpredictable landscape. This exploratory study examines how Information Technology (IT) professionals view AI in their work and how to prepare for a career in the AI Era. Using a cross-sectional survey, we collected data from technology professionals in the United States, Ghana, and Uganda. The results show that participants are concerned about the reliability of AI's output, privacy, and the need for human oversight. The participants highlighted the importance of critical thinking skills, adaptability, ongoing professional development, ethical awareness, and effective collaboration with AI systems to remain competitive. The findings highlight the importance of AI literacy, human oversight, adaptability, and continuous learning, and recommend that Career and Technical Education (CTE) programs comprehensively prepare students in both technical and soft skills, equipping them to critically evaluate and effectively collaborate with AI technologies.

Keywords
Artificial Intelligence (AI), AI integration, AI literacy, career readiness, human oversight, continuous learning, professional development, Career and Technical Education (CTE).

Introduction

Artificial Intelligence (AI) is no longer a future concept but is now actively integrated into various domains (Babashahi et al., 2024). The rapid growth and proliferation of AI tools in the workplace have accelerated both technological and business transformation in organizations. The current AI revolution is moving at a much faster pace, compressing years of transformation into months, with an estimated 40% of jobs worldwide likely to be affected (Humphries et al., 2026). This has compelled both organizations and educational institutions to reconsider what it means to be career-ready in this technology era.

The integration of AI into the workplace is continuously redefining workflows, decision-making processes, and the roles and responsibilities of professionals. As a result, professionals are adapting and learning AI tools to improve their productivity. However, organizations still face challenges in delivering internal training on AI tools to employees, as some staff receive in-depth training while others receive only a brief introduction (Muehlemann, 2025). This has significantly impacted AI adoption among several individuals due to a skills gap stemming from inadequate training.

Therefore, understanding how technology professionals perceive AI integration is becoming important for informing workforce-preparation and career-readiness initiatives. This study explores the general perceptions of Information Technology (IT) professionals regarding AI integration in the workplace, with an emphasis on adaptability and career-readiness to remain competitive. The following research question (RQ) guided the study: How do IT professionals perceive AI integration, and what are their views on remaining competitive in an AI-driven workforce? The findings are intended to share insights that may inform workforce preparation and Career and Technical Education (CTE) programs as they prepare learners for AI-driven workplaces.

Methodology

This exploratory cross-sectional study used a survey to examine technology professionals' perceptions of AI integration in the workplace and their preparation for potential future careers in AI. The study was approved by the institutional review board (IRB). The data were collected via an anonymous survey comprising 26 items: 18 closed-ended and 8 open-ended questions. The survey focused on demographic information, their perceptions and attitudes about AI integration, AI adaptability and training, and the implications for career prospects. Most survey items used either a five-point Likert scale from 1 ("Strongly Disagree") to 5 ("Strongly Agree") or a frequency scale from 1 ("Never") to 5 ("Always"). Other survey items helped to obtain qualitative data, allowing respondents to share their experiences beyond the closed-ended questions.

The target population consisted of information technology (IT) professionals who were at least 18 years old. Participants were recruited through professional networking platforms such as LinkedIn and through email. The survey link also included informed consent, and participants were free to decline to participate or withdraw at any time while completing the survey. The current preliminary findings are based on a sample of 36 technology professionals. Due to limited preliminary data, the primary mode of analysis was descriptive, supplemented by Chi-Square Tests for Independence.

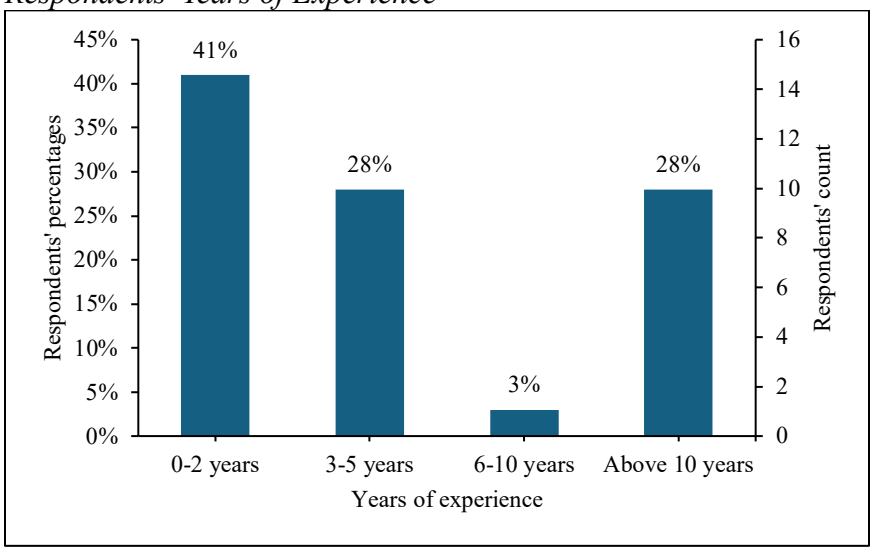
Results

Overview

The current study provides preliminary findings based on the current sample size. The objective of this study was to explore the general perceptions of Information Technology (IT) professionals of AI integration in the workplace, with an emphasis on adaptability and career readiness to remain competitive. A total of 36 participants responded to the survey. Based on self-reported data, they were IT professionals from the United States (52.8%, *n* = 19), Ghana (19.4%, *n* = 7), and Uganda (27.8%, *n* = 10). Among the respondents, 56% were male (*n* = 20) and 44% were female (*n* = 16). Figure 1 illustrates the distribution of years of experience alongside the corresponding number of individuals in each category. Figure 2 shows the number of individuals using various Generative AI (GenAI) tools. Some questions were unanswered by respondents.

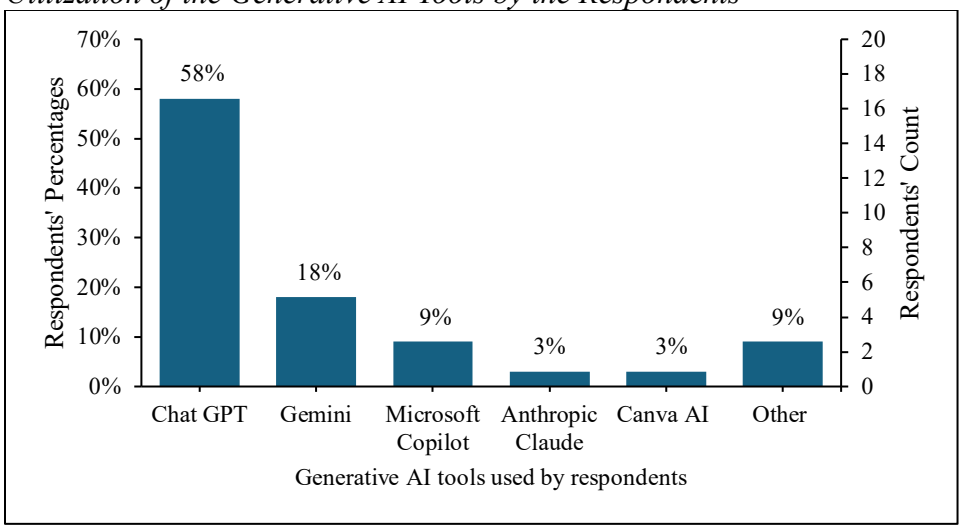
Figure 1

Respondents' Years of Experience



Note: N = 36 respondents' years of experience were distributed as follows: 0–2 years (*n* = 15, 41.7%); 3–5 years (*n* = 10, 27.8%); 6–10 years (*n* = 1, 2.8%); and above 10 years (*n* = 10, 27.8%).

Figure 2
Utilization of the Generative AI Tools by the Respondents



Note: Among the *n* = 33 valid responses, ChatGPT was selected by 19 respondents (57.6%), Gemini by 6 (18.2%), Microsoft Copilot by 3 (9.1%), Anthropic Claude by 1 (3%), Canva AI by 1 (3%), and other AI tools by 3 (9.1%).

IT Professionals' Perception of AI Integration:
To understand IT professionals' perceptions of AI integration, the survey asked questions about their general perceptions of AI integration, productivity levels, AI reliability, and AI limitations. Table 1 through 3 provides the results:

Some survey items asked about IT professionals' overall perceptions of AI integration. These items were measured on a 5-point Likert Scale ranging from Strongly Disagree (1) to Strongly Agree (5). Table 1 provides the results of these survey items. Based on the responses, participants were slightly below the neutral midpoint in rating AI integration as an important aspect of their professional activities ($M = 2.44$, $SD = 1.16$). Likewise, respondents expressed a cautious attitude toward AI in their professional roles ($M = 2.44$, $SD = 0.98$). Additionally, it appears that AI had not yet had a strong influence on their professional roles in meaningful ways ($M = 2.44$, $SD = 0.95$). Lastly, the respondents were cautious regarding the long-term positive influence of AI on their current roles ($M = 2.44$, $SD = 0.98$). Overall, since the mean across all survey items was below Neutral (3), it appears that participants were cautious about AI integration in their current roles.

Table 1
IT Professionals' perceptions of AI integration

Survey Item	N	Mean	SD
AI integration is an important aspect of my professional activities.	32	2.44	1.16
I have a positive attitude towards AI in my professional role.	32	2.44	.98
AI has influenced my professional role in meaningful ways.	32	2.44	.95
I believe AI will positively influence my current role in the long term.	32	2.44	.98

Some survey items examined IT professionals' perceptions of the reliability of AI-assisted tools. These items were measured on a 5-point Likert Scale ranging from Strongly Disagree (1) to Strongly Agree (5). Table 2 provides the results of these survey items. Per Table 2, when asked, "*To what extent do you agree with these perceptions on the reliability of AI support in technical tasks?*" Participants' responses ranged from total disagreement to near neutrality regarding the reliability of AI tools ($M = 2.81$, $SD = 1.06$). The participants also agreed that they cross-check information provided by AI ($M = 4.09$, $SD = 1.254$).

Table 2
IT Professionals' perceptions on the reliability of AI support in technical tasks

Survey Item	N	Mean	SD
I regularly use AI-assisted tools in my daily professional tasks	32	3.44	1.22
Using AI-assisted tools has improved my productivity at work	31	3.84	.97
The information given by the AI-assisted tools is reliable	32	2.81	1.06
I have to cross-check the information given by AI before applying it to my technical tasks	32	4.09	1.25

Some of the survey items examined factors influencing IT professionals' decisions to utilize AI-assisted tools at work. These items were measured using a five-point frequency scale ranging from Never (1), Rarely (2), Sometimes (3), Often (4), Always (5). Table 3 presents the responses to these survey items. As shown in Table 3, respondents reported that inaccurate or unreliable information ($M = 3.31$, $SD = 0.86$) and privacy or data concerns ($M = 3.44$, $SD = 1.16$) sometimes influenced their decisions to use AI-assisted tools at work. By contrast, participants indicated that inadequate training and guidance on using AI tools was the least frequently reported limitation influencing AI use in professional settings ($M = 2.41$, $SD = 1.13$).

Table 3
Limitations of using AI tools for professional work

Survey Item	N	Mean	SD
Inaccurate or unreliable information	32	3.31	.86
Privacy or data concerns	32	3.44	1.16
Inadequate training and guidance on how to use AI tools	32	2.41	1.13
Integration issues with existing systems	32	3.00	1.19

Career Readiness

One of the survey items asked the participants about different skills needed to be competitive in the era of AI. For these skills, participants selected their responses on a Likert scale from Strongly Disagree (1) to Strongly Agree (5). Table 4 describes the participants' responses. Participants strongly agree that adaptability and continuous learning ($M = 4.50$, $SD = 0.78$) are important skills. They also agree that Ethical and Privacy Awareness ($M = 4.45$, $SD = 0.85$) is an important skill.

Table 4

Abilities that are important to stay competitive in this era of AI

Survey Item	N	Mean	SD
Critical thinking and problem solving	32	4.38	.94
Data literacy	31	4.29	.82
Adaptability and continuous learning	30	4.50	.78
Ethical and privacy awareness	31	4.45	.85
Collaboration with AI systems	31	3.90	.83

Based on the Chi-Square Test for Independence, there was no significant relationship between sex and all the career readiness factors, with a p-value greater than .05 (Table 5). This indicates that participants generally had similar views regarding the career readiness factors irrespective of sex. Additionally, a Chi-Square test for independence revealed no significant relationship between the years of IT experience and most of the career readiness factors, with a p-value greater than .05 (Table 6). There was a significant relationship between the years of professional IT experience and collaboration with AI systems; however, these findings require additional investigation due to the small sample size.

Table 5

Chi-Square Test for Independence (Sex and Career Readiness factors)

Survey Item	Chi-Square Value	df	p-value
Critical thinking and problem solving	.489	3	.919
Data literacy	6.221	3	.101
Adaptability and continuous learning	2.368	3	.500
Ethical and privacy awareness	1.355	3	.716
Collaboration with AI systems	4.807	3	.186

Table 6
Chi-Square Test for Independence (Years of Technology Experience and Career Readiness factors)

Survey Item	Chi-Square Value	df	p-value
Critical thinking and problem solving	7.366	9	.599
Data literacy	3.735	9	.928
Adaptability and continuous learning	5.411	9	.797
Ethical and privacy awareness	7.205	9	.616
Collaboration with AI systems	19.795	9	.019

Discussion

AI Tool Utilization

The preliminary findings indicate that 58% of respondents used ChatGPT, consistent with Olavsrud's (2025) findings, in which 62% reported using ChatGPT. There could be several reasons for ChatGPT's popularity among IT professionals, such as a) it being one of the earliest widely accessible Generative AI tools available to the public, and b) its versatility across different professional tasks. One of the things that the current findings point to is that professionals are increasingly integrating AI into professional workflows and processes. Therefore, organizations should have professional development programs for employees; policies and processes for the ethical use of AI; and enforce strict human oversight.

IT Professionals perception on integration

The preliminary findings suggest that respondents were cautious about integrating AI into their current roles. They were also cautious about the long-term influence of AI on their career. There may be growing uncertainty among professionals about how automation is impacting their roles or potentially eliminating their jobs. The current findings are also consistent with those of Savolainen et al. (2026), who found that automation tools are also a source of anxiety about job security for workers. So, while people may recognize the positive impact of AI on output quality, productivity, and efficiency, there may be valid concerns about job stability and security.

Secondly, the findings show that participants are neutral or cautious about the reliability of AI tools and cross-check AI output before using it. According to McClain et al. (2025), 70% of professionals are concerned about inaccurate information from AI tools. Trust is an essential concern with the adoption of AI systems. An increasing body of research stresses that without trust, professionals are unlikely to fully integrate AI into critical workflows. Bach et al. (2022) conducted a systematic review of trust in AI-enabled systems, concluding that transparency, explainability, and perceived control are determining factors in whether users will rely on AI outputs. These findings suggest that IT professionals view these tools as supportive rather than autonomous tools. Hence, there is a need for human oversight and human judgment when working with AI tools. Without human oversight and judgment, people may accept AI output uncritically, leading to automation bias (Holzinger et al., 2024).

Implications For Career Readiness

The preliminary findings, which emphasized human oversight, critical evaluation of AI output, and ethical awareness, highlight the need for AI literacy and adaptability in professional settings. According to Long and Magerko (2020), AI literacy includes the ability to "critically evaluate AI technologies; communicate and collaborate effectively with AI." Table 4 lists some of the skills that IT professionals consider critical for competitiveness in the Era of AI. These skills include: Critical Thinking and Problem-Solving, Data Literacy, Adaptability and Continuous Learning, Ethical and Privacy Awareness, and Collaboration with AI Systems. Because these competencies were identified by practicing IT professionals, the findings provide preliminary evidence regarding the knowledge and skills that Career and Technical Education (CTE) programs should emphasize when preparing students for AI-enabled workplaces. Hence, Career and Technical Education (CTE) programs should not only focus on technical skills but must also heavily emphasize AI Literacy, Critical Thinking, Adaptability, Ethical Awareness, Human Oversight, and Collaboration with AI Tools.

Conclusion

The findings suggest that IT professionals recognize both the opportunities and challenges associated with AI integration in professional environments. Participants expressed cautious perceptions regarding reliability, privacy, and the long-term impact of AI on professional roles. Additionally, based on the preliminary data, the professionals continue to value human oversight, critical thinking, and professional judgment when utilizing AI-supported technologies.

The findings highlight the significance of AI literacy, adaptability, continuous learning, and ethical awareness in preparing for AI-driven workplaces. Therefore, Career and Technical Education (CTE) programs and workforce preparation initiatives may need to place greater emphasis on helping learners and professionals understand how to responsibly use, evaluate, and collaborate with AI-assisted technologies.

This study also has certain limitations. The most important limitation of this study is the small sample size due to time constraints. Additional data are needed to confirm the present findings. Therefore, future research may benefit from larger sample sizes and additional investigation into how AI integration is impacting various technology professions.

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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.

Acknowledgment: Grammarly's AI-assisted writing tools were used during the preparation of this manuscript solely to support grammar, language clarity, readability, and sentence-level editing.

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AI and CTE: A Literature Review of Current Professional Development Needs

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Abstract
Artificial intelligence, especially generative AI, is changing both education and the careers for which CTE prepares students, making professional development a challenge for CTE teachers. Now, teachers not only have to figure out how to use AI in the classroom but also need to prepare students for jobs where AI is part of daily work. Recent literature shows that CTE teachers need more than just basic training in AI tools, they also need skills in AI literacy, effective use in teaching, assessment, ethics, data privacy, fact-checking, and tailoring AI to their particular industry. Since many CTE teachers have industry experience rather than formal teaching training, professional development should tap into their existing skills while also giving them useful teaching strategies. The literature suggests a strong need for hands-on, ongoing training that's practical, encourages teamwork, and is customized to each career field, always keeping real industry needs in mind. Still, there is a shortage of studies focused specifically on the AI training needs of secondary CTE teachers, so more research is needed to understand where the biggest gaps are and what kinds of support work best.

Introduction

Artificial intelligence (AI) has increasingly moved from a specialized technology to a common part of education in the workplace. Generative AI applications can create text, images, code, simulations, learning resources, and even data analyses simply by responding to prompts written in everyday language (Santos et al., 2023). Additionally, AI technologies are changing occupational tasks in fields ranging from business and information technology to manufacturing, health care, agriculture, transportation, and skilled trades. As such, career and technical education occupy an especially important position in discussions about AI and education (Sun & Pratt, 2024).

Career and technical education (CTE) bridges the gap between classroom education and hands-on job skills. CTE teachers have a unique role, not only do they teach, but they also bring industry experience into the school. Their job requires them to stay current with new technologies, certifications, equipment, job standards, and what employers expect in the workplace (Stone & Lewis, 2012). With AI now reshaping many industries, these teachers must keep up with how artificial intelligence can be used in their own teaching and how it is changing the careers their students will pursue. Sun and Pratt (2024) observed that CTE has received substantially less attention in the AI-in-education literature than traditional K-12 and higher education settings. This shift matters because CTE's practical, hands-on nature and its ability to meet business and industry needs mean generic AI training may not meet CTE teachers' distinct needs. As AI tools become more common in the workplace, it is important to examine the specific skills and knowledge CTE educators need to help students succeed in these changing fields (Baidoo-Anu & Owusu Ansah, 2023; Sun & Pratt, 2024).

The purpose of this literature review is to synthesize recent literature concerning the professional development needs of CTE teachers as AI becomes increasingly incorporated into education and

the workplace. This review brings together recent research on what career and technical education (CTE) teachers need to keep abreast of the abundance of AI as AI becomes an integral part of both teaching and the workplace. The review further explores several key areas, including the basics of AI, how to use and assess AI tools in the classroom, ways to design lessons and assessments with AI in mind, ethical considerations, job-specific AI skills, the importance of strong human skills for students, and how professional development for teachers should be organized and delivered.

Conceptual Framework

The conceptual framework for understanding the professional development needs of career and technical education (CTE) teachers in an artificial intelligence (AI)-influenced learning setting is grounded in the relationship among teacher AI competency, pedagogical application, and occupational expertise. CTE teachers create a distinctive position because they must simultaneously prepare students to use emerging technologies and ensure that instruction continues aligned with changing workplace expectations. The literature suggests that effective AI competency exceeds familiarity with individual generative AI applications and includes a wider array of technical knowledge, ethical awareness, pedagogical judgment, and analytical assessment. UNESCO's *AI Competency Framework for Teachers* provides an appropriate foundation for conceptualizing these competencies through five interconnected dimensions: 1. a human-centered mindset, 2. ethics of AI, 3. AI foundations and applications, and 4. AI pedagogy, and AI for professional learning (Miao & Cukurova, 2024).

These dimensions are essential to CTE because educators must determine not only how AI can support teaching and learning as well as how AI is transforming occupational practices. Sun and Pratt (2024) emphasize that AI integration within CTE should be understood in relation to the field's applied instructional practices and strong connections with industry. Accordingly, the framework conceptualizes CTE teacher AI competency as developing through the interaction of foundational AI literacy, responsible and ethical use, instructional application, critical evaluation of AI-produced information, and knowledge of industry-specific applications. By implementing this method, the literature reviewed in this study, which identifies foundational AI literacy, prompting, instructional design, assessment, ethics and privacy, and occupationally relevant AI skills as important professional development needs for CTE educators (Sun & Pratt, 2024).

Artificial Intelligence and the influence on CTE education

CTE teachers have always helped students link what they learn in class to the skills they will need on the job. Now, with AI becoming a regular part of fields like data analysis, customer service, design, manufacturing, logistics, programming, marketing, health care, and financial services, keeping that connection up to date is more challenging (Organisation for Economic Co-operation and Development, 2025a). As AI keeps changing the way people work, schools need to think carefully about what students should know and be able to do to be ready for the jobs of tomorrow (Organisation for Economic Co-operation and Development [OECD], 2025a).

The implications spread beyond teaching students how to operate AI applications. CTE teachers must determine when AI enhances occupational performance, when human decision processes are still necessary, how AI-generated information should be evaluated, and how workers can cooperate effectively with intelligent systems. The *Center for Public Education* (2025) states that

CTE programs should simultaneously develop AI-related capabilities and durable skills such as communication, critical thinking, problem solving, and adaptability.

Recent CTE literature similarly stresses the revolutionary implications of AI. Crevar et al. (2026) describe AI as capable of enhancing instruction, improving efficiency, supporting personalized learning, and providing data that teachers can use for focused interventions. However, the authors also emphasize challenges involving algorithm bias, privacy, moral decision-making, and preserving the human dimensions of education. Altogether, these changes will affect how AI is integrated into the classroom to prepare for skills to meet the 21st century.

Foundational AI Literacy

Before CTE teachers could effectively use AI in their classrooms, they need a solid grounding in the basics of artificial intelligence. Without this foundation, educators struggle to make thoughtful choices about how, when, and why to incorporate AI tools into instruction. Professional development should therefore emphasize building core AI literacy before moving on to more advanced or applied topics (Holmes et al., 2021).

UNESCO's *AI Competency Framework for Teachers* provides a pertinent framework for conceptualizing this need. Miao and Cukurova (2024) identify 15 competencies organized into five dimensions: a human-centered mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning. The framework further organizes teacher development into three levels: Acquire, Deepen, and Create, showing that AI competency.

For CTE educators, foundational literacy should include an understanding of what generative AI can and cannot do, how machine-learning systems depend on data, why generative models may produce inaccurate information, and how algorithmic systems can reproduce biases found in their training data or design (Miao & Cukurova, 2024; Pan et al., 2021). Teachers should also understand the differences between predictive AI, generative AI, automation, and other technologies encountered in contemporary workplaces.

AI Output and Evaluation

Knowing how to work effectively with generative AI is now a key skill for teachers. They need hands-on practice creating prompts that give explicit context, outline the goals, set any limits, and guide the AI toward better outputs over time. This skill is especially important in career and technical education, where the accuracy and usefulness of AI's answers commonly rely on using the right industry terms and grasping the specific work environment (Kovanović et al., 2023).

CTE teachers can use carefully crafted prompts to create case studies, workplace scenarios, tailored explanations, project ideas, formative assessments, technical problem-solving tasks, or simulations. Still, generating content is just one part of using AI well; teachers also need to be able to critically evaluate the accuracy and usefulness of what AI produces (Zawacki-Richter et al., 2022).

Generative AI tools can produce information that sounds credible but may be wrong or misleading. In CTE classes, using inaccurate instructions can lead to financial losses, technical mistakes, legal problems, or safety risks (Luckin et al., 2016). Because of this, teachers need

training that encourages them to double-check AI-generated material and use their own judgment, rather than accepting it at face value.

AI-Supported Pedagogy and Instruction

Research shows that professional development should help teachers go beyond simply experimenting with AI tools and instead focus on using them with clear purpose in their instruction. Just knowing how to type a prompt into an AI program does not mean it will actually improve learning. Teachers need time and support to figure out when AI genuinely supports a lesson and when it might distract from or even hinder student understanding (Trust et al., 2022).

The OECD (2025b) argues that effective digital education requires adaptation of pedagogy rather than simply reproducing existing instructional practices with digital technologies. Professional learning should therefore help teachers connect technical resources to sound instructional decisions.

It can be noted that teachers need more than just basic exposure to AI tools; they need support in figuring out how to use AI intentionally in their teaching. Just because someone knows how to enter a prompt does not mean technology will help students learn. Professional development should give teachers time to explore when AI can genuinely support a lesson and when it might actually interfere with student understanding (Pan et al., 2021).

An emerging example is the *Center on Education and Training for Employment* at The Ohio State University, which has developed professional development specifically for career-technical educators. The workshops have allowed CTE teachers to identify gaps in their own AI knowledge, experiment with generative AI as an instructional advisor, look at student assessment data, and understand the importance of AI-supported instructional plans connected to industry-specific competencies (Center on Education and Training for Employment [CETE], 2026).

Assessment, Integrity, and Authentic Learning

Generative AI is arguably requiring teachers to rethink how they assess student learning. When students can use advanced AI tools to produce written work in seconds, take-home assignments are no longer a reliable way to measure what students know and understand. This shift means teachers urgently need professional development to design assessments that better represent authentic student learning (Baidoo-Anu & Owusu Ansah, 2023).

Professional development should help CTE teachers shift their assessments toward real-world tasks and hands-on demonstrations. This change makes sense for CTE, since many programs already rely on labs, projects, simulations, work experiences, and technical skill checks to measure student learning. Giving students opportunities to show what they can actually do—rather than just what they can write—offers a better picture of their readiness for the workforce (Wang et al., 2022).

Rather than attempting to eliminate AI from every assignment, educators may need to distinguish between tasks in which AI use is prohibited, tasks in which AI is permitted as a support, and tasks specifically designed to assess students' ability to use AI responsibly. Students might critique an AI-generated troubleshooting procedure, compare an AI recommendation relative to

industry benchmarks, improve an AI-generated business plan, or document how human decisions changed an AI-produced solution.

Ethics, Privacy, Bias, and Responsible AI

Understanding and using AI responsibly is central to being an effective teacher today. UNESCO highlights ethics as just as important as technical skills and instructional techniques when it comes to working with AI in the classroom (Miao & Cukurova, 2024). For CTE teachers, this means professional development should cover issues like privacy, intellectual property, bias, transparency, accessibility, misinformation, and making sure people, and not just machines, remain accountable.

Data privacy is especially important in today's classrooms. Teachers and students sometimes enter personal details, student records, or even confidential employer information into public AI tools without realizing the risks. Professional development should clearly explain school or district policies and help educators recognize what information should never be shared with outside AI platforms (Willis et al., 2023).

Bias is a serious concern in AI. These systems can reflect and even bolster stereotypes and inequalities that exist in the data they are trained in how they are built. CTE teachers should understand that algorithmic discrimination can influence decisions in areas like hiring, job evaluations, finance, health care, criminal justice, and marketing, all of which can have real impacts on people and communities (Mehrabi et al., 2021).

AI Competencies for Business and Industry

Perhaps the most important distinction between general teacher AI professional development and CTE-specific professional development is the need for occupational relevance. AI is not affecting every industry in identical ways. A business teacher, automotive instructor, health-science educator, welding instructor, agriculture teacher, and cybersecurity teacher may all need AI competency, but the applications relevant to their programs will differ considerably.

Sun and Pratt (2024) stress the importance of contextualizing AI adoption within CTE's distinctive pedagogical practices and industry relationships. Professional development should therefore include career-cluster-specific learning opportunities rather than relying exclusively on generalized workshops.

Changes to the National Career Clusters Framework highlight how important it is for students to understand AI. Advance CTE (2026) describes AI literacy as a useful skill in many careers and shows that AI use can vary widely from one industry to another. To keep programs relevant, educators should work closely with industry partners, advisory boards, employers, professional groups, credentialing bodies, and workforce agencies to learn which AI tools and practices are used on the job.

Transferrable Skills in an AI-Enhanced Workplace

As AI continues to increase its usage and its role in the workplace, some human abilities are becoming more valuable, not less. Skills such as clear communication, creative problem-solving, critical thinking, and adaptability continue to be harder for machines to replicate and set people

apart in the job market. According to the Center for Public Education (2025), these durable skills are a key part of career and technical education, especially while technology keeps changing how we work. Employers are looking for graduates who can not only use new tools but also work well with others, cope with unexpected challenges, and think on their feet. For CTE programs, this means putting just as much emphasis on teaching these basic skills as on technical know-how, so students are ready to succeed in an economy defined by AI.

CTE teachers need professional development that shows them how to use AI in the classroom without taking away chances for students to think for themselves. When AI handles every draft, calculation, or troubleshooting step, students miss out on building the real-world skills needed to judge when AI gets things wrong. Ongoing training should help teachers create lessons where AI supports but does not replace student thinking. Students should be encouraged to question AI's suggestions, justify their choices, weigh different options, and use their subject knowledge to make final decisions (Pan et al., 2021; Trust et al., 2022).

Structuring Ongoing Professional Development

The literature suggests that the format of AI professional development may be nearly as important as its content. One-time workshops are unlikely to be sufficient given the speed with which AI technologies and workplace practices are changing.

The OECD (2025b) describes teacher professional learning as ongoing, not a one-time event. Ongoing learning is regarded as essential for teachers to keep up with digital education. UNESCO also encourages this kind of steady growth, outlining stages from basic understanding to deeper knowledge and creative application, showing that real development takes time and repeated effort (Miao & Cukurova, 2024).

For CTE educators, effective AI professional development should be hands-on, contextualized within career fields, result in usable instructional products, provide time for collaboration and reflection, and be revisited regularly as AI technologies and industry expectations evolve.

Barriers to Professional Development and AI Adoption

Even well-designed professional development will not guarantee successful AI adoption if organizations ignore systemic barriers. Sun and Pratt (2024) identify infrastructure, equitable access to resources, and organizational culture as important considerations affecting AI permeation within CTE.

Opportunities to use AI in the classroom vary by school. While some teachers have access to paid platforms, up-to-date computer labs, and administrative support, others find that AI websites are blocked or that school policies are unclear about what is allowed. Time is another real challenge for CTE teachers, who are already overextended by the need to stay current in their field, maintain certifications, oversee labs and equipment, lead student organizations, connect with advisory committees, and manage work-based learning partnerships (Baidoo-Anu & Owusu Ansah, 2023; World Economic Forum, 2023; Trust et al., 2022).

Policy uncertainty can discourage experimentation. Teachers need clear guidance regarding acceptable student AI use, privacy, copyright, assessment, and approved platforms. Professional

development should therefore be accompanied by coherent institutional policies rather than placing responsibility entirely on individual teachers.

Implications for CTE Leaders and School Districts

The literature suggests that AI training should not be treated solely as an information-technology initiative. Because AI affects curriculum, instruction, assessment, ethics, and workforce preparation, professional development requires collaboration among CTE administrators, instructional leaders, technology personnel, industry advisory committees, and classroom teachers.

Before introducing any AI training, school districts should speak with teachers and find out what support they need. Not everyone has the same experience with these tools. It makes sense to start with the mechanics of AI: what AI is, how to write prompts, privacy issues, and how to recognize bias. Once teachers are comfortable with the foundation, the next level may examine the impact on lesson planning, assessment, adapting instruction for different learners, and using AI for job-specific tasks. To strengthen ongoing support, training could include cooperating with industry partners, updating courses, using AI to analyze data, or leading efforts to bring new technology into the school (Trust et al., 2022).

Professional development should also be connected to measurable effects. Evaluation should go beyond participant satisfaction and assess whether teachers show increased AI competency, adjust instructional practices, improve curriculum alignment, and better prepare students for AI-influenced workplaces.

Areas to consider for future research

Although research concerning AI in education is expanding rapidly, a substantial gap remains regarding the professional development needs of secondary CTE teachers specifically. Sun and Pratt (2024) note that CTE has frequently been overlooked in AI-in-education research.

Future research could examine national and state-level needs assessments measuring CTE teachers' current AI knowledge, confidence, use, and perceived professional development needs. Research should also compare needs across career clusters because the AI competencies required in health science may differ considerably from those required in business, manufacturing, information technology, agriculture, or transportation.

Researchers could also investigate whether professional development needs differ according to years of teaching experience, occupational experience, certification pathway, school setting, and prior technology experience. Future studies could consider specific professional development models, such as workshops, coaching, professional learning communities, industry externships, and even online modules.

Finally, research should examine whether teacher AI professional development affects student outcomes, including AI literacy, technical skill attainment, career readiness, critical thinking, industry credential performance, and students' ability to evaluate AI-generated information.

Conclusion

Artificial intelligence presents both a technological change and a workforce development challenge for career and technical education. CTE teachers occupy a distinctive position because they must use emerging technologies effectively as educators while also preparing students to enter industries being transformed by those technologies.

The literature indicates that professional development must go beyond introducing teachers to popular AI applications. CTE educators require foundational AI literacy, effective prompting skills, pedagogical strategies, assessment redesign, ethics and privacy awareness, critical evaluation skills, and knowledge of industry-specific AI applications. They must also understand how to develop durable human skills that continue to be essential when workers collaborate with increasingly capable AI systems.

Effective professional development should be continuous, practical, collaborative, differentiated, and closely connected to industry. The relative paucity of empirical research focused specifically on CTE teachers is still a major limitation. Large-scale needs assessments, career cluster comparisons, and evaluations of CTE-specific professional development programs would substantially strengthen the need for this type of professional development.

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