CTE Teacher Preparedness for Including Generative Artificial Intelligence in Pedagogy

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Introduction

Artificial intelligence (Ai) is being leveraged in many career fields in diverse ways to make work more efficient. From chatbots and phone systems that answer customer service needs to doctors using AI programs to assist in charting so they can increase quality time with patients. AI is revolutionizing how we work (Wu, 2024) Career and technical education teachers (CTE) need to leverage this technology. CTE is a diverse field containing multiple courses that lead to multiple career pathways and is situated to become early adopters of this technology in the secondary school setting.

The focus of this research will be on the point of view of the practicing CTE teacher and how prepared they feel to incorporate generative artificial intelligence (Gen AI) into their pedagogical practice. Equipping in-service CTE teachers with the tools and best practices of Gen AI is crucial if CTE teachers are to prepare students who are career ready post high school graduation. This requires inquiry into the state of Gen AI in the CTE classroom, which is all but non-existent in the literature.

Participation in the study will be from one large, urban midwestern district's CTE teaching staff. The quantitative and qualitative data gathered from the district will be used to inform the district on how to roll out Gen AI tools in the CTE classroom while supporting teacher learning and teacher Gen AI proficiency. The district houses multiple secondary schools that offer many different CTE pathways under the career fields outlined by the state.

Problem of Practice

The XYZ school district is preparing to introduce Gen AI tool(s) district wide as well as update their AI policy in accordance with the recommendations of the state's Department of Education and Workforce Development. The State has provided a recommended framework for how Gen AI tools can be governed and used inside of districts while allowing districts autonomy

in how they choose to implement those recommendations (Innovate Ohio, 2024) The XYZ district would like to begin implementing AI with and for CTE programs as a use case for the efficacy of Gen AI Tools that impact classroom learning.

This is contrary to the current Gen AI policy of the district, which has implemented a student no-use policy. Currently teachers have access to some Gen AI tools; Microsoft Co-Pilot and Canva AI. The district blocks the use of Gemini (Google Gen AI) or tools like ChatGPT on their network because of the student no-use policy, which also means teachers are unable to access those tools along with other Gen AI tools outside of Microsoft Co-pilot and Canva AI. The district is also undergoing a process of centralized procedure and policy making. Prior to this effort the district was de-centralized in nature, allowing principals full autonomy in running primary and secondary schools. Part of this policy making is centralizing the tools schools use to make more efficient procurement and instructional decisions, giving all students equal access to technology and the same chance at an education that prepares students for career and college.

Purpose of the Study

It is the goal of this research to accumulate and document quantitatively and qualitatively CTE teacher described Gen AI readiness into one body of work so that it may inform future use of Gen AI enabled tools for the CTE classroom in the XYZ district prior to Gen AI tools being rolled out in the district. This study will inform how CTE teachers can be supported in implementing Gen AI tools into their classroom pedagogy. Gen AI is here to stay. How educators, administrators, and policy makers decide to leverage Gen AI in CTE education is paramount to the future development of the local and national workforce. It is important to the development of teaching and learning that those who facilitate learning be included in the discussion and design of how teaching and learning might progress with advanced technologies such as Gen AI.

Given the current situation in Gen AI use, it is important for the district to understand where to start with CTE teacher professional development to ensure when these tools are introduced, they are adopted into the CTE teacher wheelhouse, used inside of the classroom, and CTE teachers are given the best chance to improve classroom engagement and learning with Gen AI tools. Here in lies the problem of practice; fulfilling the need of understanding teacher understanding and current use of Gen AI tools so that Gen AI tools can be adopted efficiently into the classroom and teachers can be supported through professional development in that adoption.

Research Question

1) What is the Gen AI adoption readiness level of CTE teachers in XYZ district as rated by the intelligent-TPACK framework? (appendix A)
2) How do in-service CTE teachers at XYZ district describe their readiness to integrate Gen AI into their pedagogical practice?

Significance

At this moment, there is an opportunity to learn what in-service CTE teachers need to implement AI tools in the classroom to propel learning and engagement. The XYZ district is a pre- Gen AI tool district for student use and because of the size and diverse population of the district, this study makes a use case for other urban districts in the country that are endeavoring to add AI to the CTE teacher's classroom and student learner's toolkit.

Utilizing the intelligent- Technology, Pedagogy and Content Knowledge (intelligent-TPACK) framework (Yin and Kim, 2025) to describe CTE teacher readiness to integrate Gen AI technology will further develop and support thought into how TPACK (Niess, 2017) can be used to assess teacher readiness to adopt new technologies into teaching practice. Because of the nature of CTE, there are many different pathways with differing content and but similar contexts.

Each career pathway has its own unique set of skills and knowledge. The vast majority of TPACK research drills down into one specific content area and contexts, given the nature of CTE and the multiple types of content areas, this research will support a more generalized understanding of teacher readiness within the intelligent-TPACK framework. This will provide a vantage point into CTE that will not only provide data for XYZ district but a starting point for further research into TPACK in the CTE classroom.

Literature Review

Gen AI is a computer system that can reason, think, and learn in similar ways to human intelligence by accessing large language models to generate content (Fakhar, et al, 2024) Gen AI can be leveraged in the classroom to analyze data, automate routine tasks, aid in the creation or differentiation of lesson plans, or serve as a thought partner in examining ideas on classroom projects (Google, 2025) Other systems exist that allow for intelligent tutoring of students like Khan Academy and SchoolJoy applications.

Research into using Gen AI in the classroom has been almost exclusively dedicated to the K-12 academic and higher-education classrooms (Sunn and Pratt, 2024) Therefore, since CTE is the application of academic knowledge to the world of work, research into integrating technology in the academic classroom and the pedagogical practices of academic teachers will be used to provide a baseline framework for this study. Recent history has seen an acceleration of technological advances, and those advances have found their way into academic and CTE classrooms as the demand to prepare students for an advancing technological landscape has become ever more important.

Conceptual Framework

Technological, Pedagogical, and Content Knowledge (TPACK) a research-developed framework based on teachers' integration of technology into teaching practice (Niess, 2017), shows the

confluence of these elements; technology, pedagogy, content knowledge and contexts are needed to effectively teach in the 21st century. See image 1 below for visual reference of the components. The TPACK framework is based on the work of Shulman with the Pedagogical Content Knowledge (PCK) framework (1986) The development of the various elements of TPACK (Nies, 2017 and Mishra, Koehler, 2013) and the intelligent-TPACK scale (Yin and Kim, 2025) developed along with the progress of technology and its eventual integration into the classroom expanding the framework from PCK to TPACK.

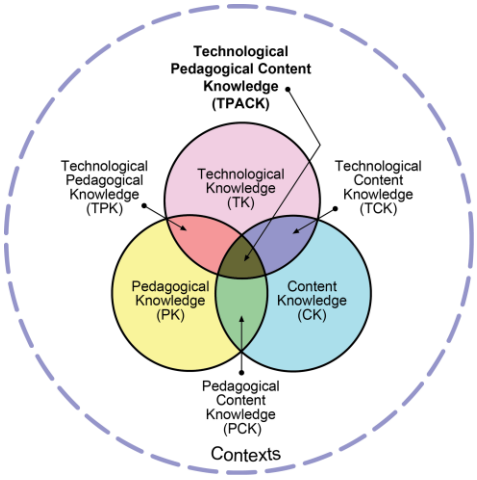

Figure 1. Reproduced by permission of the publisher, © 2012 by tpack.org

TPACK (Nies, 2017 and Mishra, Koehler, 2013) and the intelligent-TPACK (Yin and Kim, 2025) scale have primarily been used to understand the academic classroom, the framework can also be used to understand CTE instruction. Gen AI is a tremendous leap forward in technological advancement; we are now again at a stage where teachers will be required to teach with tools they have little to no experience learning with. The good news is that Niess (2013) shows that teachers with a higher rating of integrating technology into the framework of the classroom transition faster through the process of integrating new technology into their pedagogy. It is through this lens, the TPACK framework and the intelligent-TPACK scale, that

we may be able to see teachers' readiness to adopt Gen AI into their pedagogical practices and identify places where teachers could use support (Yin and Kim, 2025) While TPACK studies answer some questions of what teachers should be afforded to learn how to teach with new technologies, it does not include the nuance of the CTE classroom or of the CTE teacher who has come from industry to teach.

General education teachers struggle with applying Gen AI instructionally because of a knowledge gap in understanding all its uses and capabilities (Sunn and Pratt, 2024), even with the many tools that have been developed utilizing AI and Gen AI into classroom learning. At the same time, despite this knowledge gap, sixty percent of teachers surveyed (Horn, 2024) are experimenting with using Gen AI for preparing student feedback and other administrative tasks including parent emails (Kolhatin, 2025) These early adopters may not completely understand how to teach with the technology but are in the process of assimilating the efficiency of AI into their workflow. Finding out the state and status of CTE teacher adoption is an important first step in developing teacher professional development.

Methodology

Research Design

Adopting a mixed methods explanatory design approach, the study will consist of a survey instrument in which CTE teachers self-assess their level of intelligent-TPACK followed by a semi-structured interview. The interview will dive deeper into the why of their ratings. This explanatory approach seeks to understand and provide insight into the why's of teacher ratings (Morell & Carroll, 2010) Teachers will have the option to opt-in for an in person or virtual semi-structured interview study after the survey has been completed. The semi-structured interview will closely follow a script to be developed after the survey results and will allow for some deviations in questioning for follow up inquiries (Morell and Carroll, 2010) Purposive sampling

will take place, meaning teachers will be recruited from a variety of rating categories (Morell and Carroll, 2010)

The real time individual interviews will provide CTE teachers a chance to expand their ratings while the interviewer asks deep probing questions to gain further insight into the present-day Gen AI readiness of the CTE teacher. During the interview sessions, participants will be asked to bring with them a scope and sequence for the course and examples of lesson designs from a unit of study within the scope and sequence. These documents will be evaluated on a rubric and will help to triangulate participant responses and participant TPACK status.

This study design is most appropriate as I seek to quantify the ratings teachers assign to themselves to get an overview of where teachers are regarding the intelligent-TPACK scale and their level of preparedness for integrating Gen AI tools, as well as seek to explain the reasons for those ratings from a representative sampling of all teacher ratings.

Participants

Study participants will be recruited at XYZ district's professional development events at the beginning of the 2025/2026 school year. Participation in the survey and subsequent interviews will be completely voluntary. All participants will be in-service CTE teachers from XYZ district for the 2025/2026 school year.

Data Collection and Analysis

Data will be collected throughout the fall semester of the 2025/2026 school year. The qualitative data will be thematically analyzed and organized for findings that are significant to the problem of practice, helping inform the district on how current CTE teachers could be prepared for successful Gen AI integration into classroom learning. The survey data will be analyzed through descriptive statistical analysis to include measures of central tendency to provide a summary of the groups' rating along with a frequency distribution. The statistical

analysis will provide an overview of teacher readiness while the qualitative data will go into explaining the reasoning for the ratings. The data results from the rubrics will be examined and reported through descriptive statistics to show score variances.

Limitations

According to Morell and Carroll, generalizability refers to findings being able to be applied outside of the setting in which the observations were gathered (2010) In this study, the generalizability will be limited since the sample will be a small and not diverse in the sense that it covers one district only. The purpose of this study is to find quantitative and qualitative information that will help the XYZ district in adopting Gen AI tools for classroom instruction and learning. While there may be sentiments that are found in common with teachers in other settings, the information applicability is only for this district setting. With this being the nature of the study, further study with a larger sample size would be required to prove any sort of applicability to settings outside of XYZ district. The explanatory nature of the study design will help triangulate, add meaning, and nuance to teacher self-ratings, it is still a self-reporting tool with limitations and bias.

Ethical Considerations

Receiving approval from the IRB at Kent State to conduct the study is of utmost importance. All sensitive information will be protected for individual participants by using pseudo-names in place of real names and the institutions of work. Steps will be taken to protect the individual participants' names by not using identifiable information in any written document associated with the study. I will also redact any identifiable information from documents shared with me and assign participants numbers for the evaluation process. The participants will be informed of all parts of the study prior to their participation in the study with full transparency as full consent will be gathered.

Positionality

I am a former CTE educator turned CTE administrator whose work has primarily been with urban, minority youth. I am also a daughter, sister, and aunt from a diverse family. Diversity of thought is not only beautiful but needed. It is needed in situations where decisions are made for the good of everyone. I have come to appreciate diversity of culture and thought because of my family background and my background as a designer.

Administrative decisions made for a community of learning should represent everyone in the community they serve. My worldview is from a systems point of view, and I believe systems can be intentionally designed to increase access and representation. Often decisions are made with the best intentions but without thinking about all the ramifications, making decisions like this negate the views of others and reduces the efficacy of those decisions. The designer side of me informs this belief. When systems and policies are designed for everyone, inclusive of diversity of thought, race, ability, gender, and identity, it turns out better.

This is the starting viewpoint for my research, that deep understanding of the CTE teachers' readiness to integrate Gen AI tools needs to be done before any Gen AI tool is proscribed for the CTE classroom. The CTE teacher should have a stake and participate in the process of the decisions made for them. This is only the beginning step of inquiry into this topic. As a designer, researcher, and former educator I would inquire into how teachers imagine these tools being used in the classroom and to gather insight that could be productive in providing tools for teachers that improve student learning and engagement, as well as improve pedagogical practices of CTE teachers using the TPACK framework.

Conclusion

AI is revolutionizing how we work (Wu, 2024) Career and technical education teachers need to leverage this technology to produce a present-and future-ready workforce. It is with this study

that the needs of CTE teachers within XYZ district will be examined and recommendations will be made for future professional development which may also aid other districts in similar settings on how to develop professional learning for their CTE teachers. The integration of technology with pedagogy and content knowledge is a necessity in today's classrooms and specifically crucial to the CTE classroom.

Appendix

Survey Instrument

Teacher self-ratings will be on a 5-point Likert scale.

1. Strongly Disagree
2. Disagree
3. Neither Agree nor Disagree
4. Agree
5. Strongly Agree

Intelligent TK

• I know how to interact with AI-based tools in daily life.

• I know how to execute some tasks with AI-based tools.

• I know how to initialize a task for AI-based technologies by text or speech.

• I have sufficient knowledge to use AI-based tools.

• I am familiar with AI-based tools and their technical capacities.

Intelligent TPK

• I can understand the pedagogical contribution of AI-based tools to my teaching field.

• I can evaluate the usefulness of feedback from AI-based tools for teaching and learning.

• I can select AI-based tools for students to apply their knowledge.

• I know how to use AI-based tools to monitor students' learning.

• I can interpret messages from AI-based tools to give real-time feedback.

• I can understand alerting (or notification) from AI-based tools to scaffold students' learning.

• I have the knowledge to select AI-based tools to sustain students' motivation.

Intelligent TCK

• I can use AI-based tools to search for educational material in my teaching field.

• I am aware of various AI-based tools which are used by professionals in my teaching field.

• I can use AI-based tools to better understand the contents of my teaching field.

• I know how to utilize my field-specific AI-based tools (e.g., intelligent tutor for Math).

Intelligent TPACK

• In teaching my field, I know how to use different AI-based tools for adaptive feedback.

• In teaching my field, I know how to use different AI-based tools for personalized learning.

• In teaching my field, I know how to use different AI-based tools for real-time feedback.

• I can teach a subject using AI-based tools with diverse teaching strategies.

• I can teach lessons that appropriately combine my teaching content, AI-based tools, and teaching strategies.

• I can take a leadership role among my colleagues in the integration of AI-based tools into our teaching field.

• I can select various AI-based tools to monitor students' learning in my teaching process.

Ethics

• I can assess to what extent AI-based tools consider individual differences (e.g., race and gender) of all students in my teaching.

• I can evaluate to what extent AI-based tools behave fairly to all students in my teaching.

• I can understand the justification of any decision made by an AI-based tool.

• I can understand who the responsible developers are in the design and decision of AI-based tools.

References

Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 online distance educators in the United States *Contemporary Issues in Technology and Teacher Education*, *9*(1). https://citejournal.org/volume-9/issue-1-09/general/examining-tpack-among-k-12-online-distance-educators-in-the-united-states

Fakhar, H., Lamrabet, M., Echantoufi, N., khattabi, K. E., & Ajana, L. (2024). Towards a New Artificial Intelligence-based Framework for Teachers' Online Continuous Professional Development Programs: Systematic Review. *International Journal of Advanced Computer Science & Applications*, *15*(4). https://doi.org/10.14569/IJACSA.2024.0150450

Google.2025. Advancing Education with AI. Google. https://edu.google.com/intl/ALL_us/ai/education/

Horn, A. H. (2024). PULL BACK THE CURTAIN ON AI. Techniques - Association for Career and Technical Education, 99(8), 2.

InnovateOhio. (2024). AI toolkit: Guidance and resources to advance AI readiness in Ohio schools. InnovateOhio. Retrieved from innovateohio.gov

Kolhatin, A. O. (2025). Generative artificial intelligence in teacher training: a narrative scoping review. CTE Workshop Proceedings, 12, 1–18. https://doi.org/10.55056/cte.920

Mishra, P., & Koehler, M. J. (Eds.). (2016). *Handbook of technological pedagogical content knowledge (tpack) for educators*. Taylor & Francis Group.

Morrell, P. D., & Carroll, J. B. (2010). *Conducting educational research : a primer for teachers and administrators*. Sense Publishers.

Niess, M. (2017). Technological pedagogical content knowledge (TPACK) framework for K-12 teacher preparation: Emerging research and opportunities: [hardcover] (1st ed.). Information Science Reference, an imprint of IGI Global. https://doi.org/10.4018/978-1-5225-1621-7

Niess, M. L. (2013). Central component descriptors for levels of technological pedagogical content knowledge. Journal of Educational Computing Research, 48(2), 173–198. doi:10.2190/EC.48.2.ddoi:10.2190/EC.48.2.d

Shulman, L.S (2013). Those Who Understand: Knowledge Growth in Teaching. *Journal of Education (Boston, Mass.), 193*(3), 1–11. https://doi.org/10.1177/002205741319300302

Sun, J.C.; Pratt, T.L. Navigating AI Integration in Career and Technical Education: Diffusion Challenges, Opportunities, and Decisions. Educ. Sci. 2024, 14, 1285. https://doi.org/10.3390/ educsci14121285

Wu, Y. (2024). Revolutionizing Learning and Teaching: Crafting Personalized, Culturally Responsive Curriculum in the AI Era. Creative Education, 15, 1642-1651. https://doi.org/10.4236/ce.2024.158098

Yin Hong Cheah, Jingru Lu, & Juhee Kim. (2025). Integrating generative artificial intelligence in K-12 education: Examining teachers' preparedness, practices, and barriers Integrating generative artificial intelligence in K-12 education: Examining teachers' preparedness, practices, and barriers. *Computers and Education. Artificial Intelligence*, *8*, 100363.