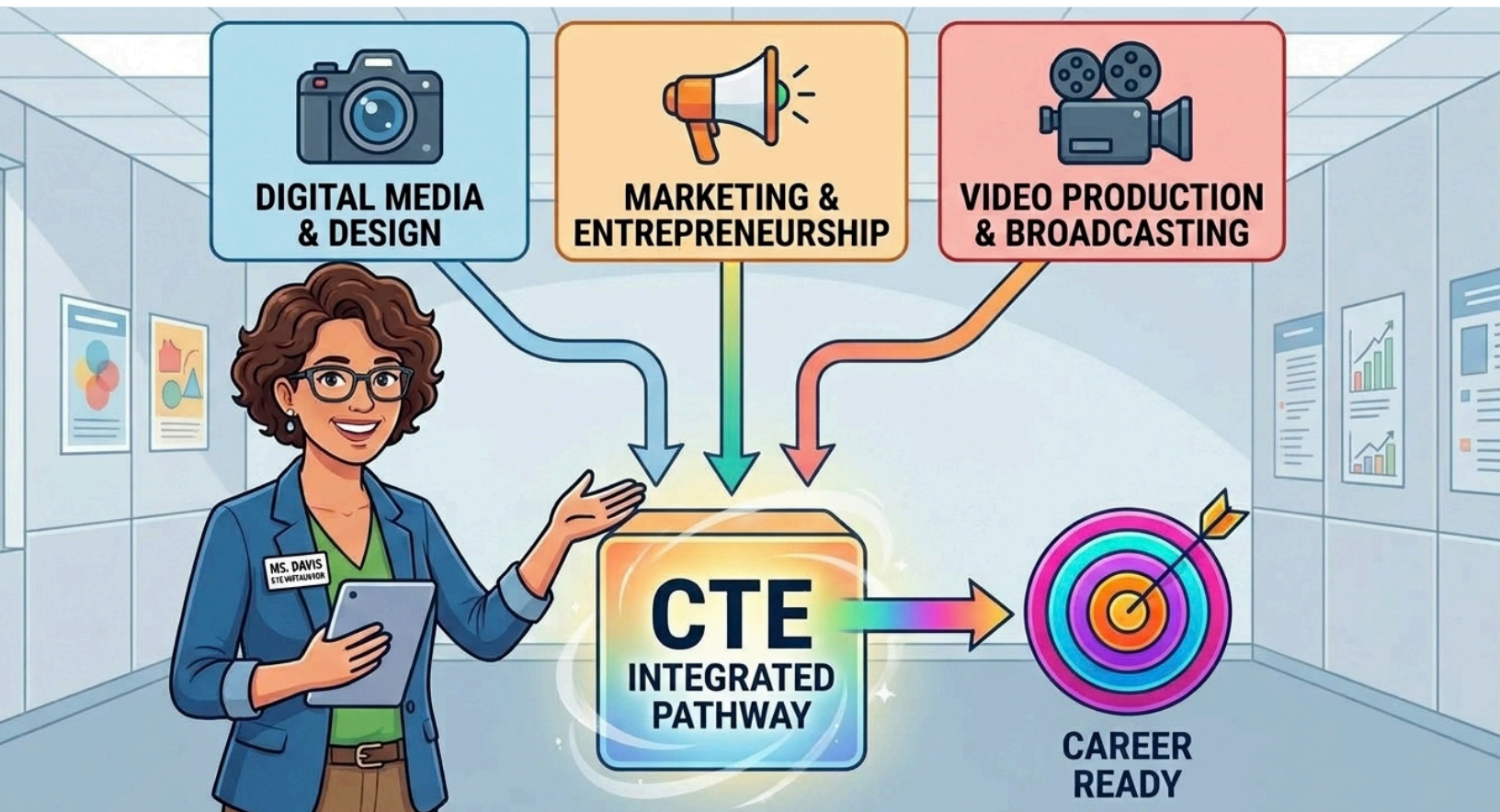




An AI Tutor for a Multi-Track Computer Science CTE Course

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The purpose of the Center for the School of the Future is to promote empirically validated practices in public education systems and to encourage cooperative and research relationships between K-12 and higher education institutions.

Overview

In a Canyons School District (CSD) computer science CTE class, a teacher designed and built a custom AI to support three different student interest tracks within the same classroom: a Business Track for students using and developing AI to solve business problems, a Creative Track for students designing AI-powered visual products, and a Computer Coding and Programming Track for students building AI systems with deep programming knowledge. The custom AIs were loaded with content knowledge specific to each track, allowing students to ask questions and receive just-in-time guidance and feedback on what they were working on. They also allowed AI to bring ideas as a symbiotic learning and thought partner. To give students authentic exposure to industry-relevant tools, the custom AIs were implemented using Gemini Gem so every student gained hands-on experience with it.

The Problem: One Teacher, One Classroom, Three Different Learning Paths

In CSD, computer science as a CTE pathway is no longer a single subject. Students arrive in the program with different goals: some want to use AI to analyze a market or automate a small business workflow; some want to design AI-powered apps and creative products; and some want to write the code and develop models that make AI work under the hood. With only one teacher in the room, providing meaningful, individualized guidance to all three groups simultaneously is nearly impossible. Whole-class lectures reach the learners in the middle of each track and miss lower- and higher-performing students.

Students on the business and creative tracks often feel the course is too technical, while students on the computer science track feel under-challenged. Just as importantly, students need answers in the moment they get stuck—not the next day, and not after the class has moved on.

The teacher needed a way to deliver track-specific, on-demand support within a single course without splitting the class into three separate courses. The teacher was also concerned that students within each track had very different levels of understanding of the content. The teacher initially had incomplete knowledge of students' strengths and gaps, but over time, she gained a more complete knowledge that allowed her to provide key instructional scaffolding in current learning activities and intuit when students were ready to move into the next critical level of content. Still, managing these needs among three different tracks was challenging.

The Solution: A Track-Aware Custom AI

The teacher built a custom, track-aware AI, preloaded with the content knowledge, vocabulary, examples, and project expectations for each of the Business, Creative Visuals, and Computer Science tracks. Before initiating with the AI tutor, students received a short onboarding lesson on how to start an AI use session, declare their track, and ask productive questions. Beyond setup, the recurring work for the teacher was reviewing conversations between AI and students, identifying gaps, and refining the AI's instructions and examples, track by track.



When students asked a question, they could indicate which track they were working in, and the AI responded with guidance, examples, and follow-up prompts that were appropriate to that specific track. In practice, this meant that the AI drew on track-specific curriculum, project rubrics, and worked examples so that the same question about a concept or task yielded a different, track-relevant answer, depending on whether the student was approaching it from a business, creative, or computer science perspective.

Because the tutor was available whenever students worked, it provided just-in-time learning support: explanations, hints, and links to resources at the exact moment students became stuck on a project, rather than forcing them to wait for teacher support or until the next class period. The AI handled a wide range of routine questions in this way, allowing students to keep progressing, while the teacher remained responsible for deeper instructional moves. The AI could respond to students' questions at varying levels of performance and help them move forward, but it could not fully account for each student's broader learning history. That was the teacher's role—fielding more advanced content questions that emerged from AI-supported work and stepping in directly when a student's misconceptions or gaps in understanding required conceptual reteaching that the AI could not provide on its own.

Key Outcomes

The teacher distributed two end-of-course surveys (n = 30 student responses; 16 Creative, 10 Computer Science, 4 Business). The surveys contained 14 total questions: one multiple-choice question, eight Likert-scale questions, and five open-ended questions. Students reported the following:

- AI provided track-relevant support: 68% of students agreed or strongly agreed, and 6.8% were neutral, that the AI gave them support and answers relevant to their track (mean 3.77/5).
- AI helped them move forward when stuck: 64% agreed or strongly agreed and 36% were neutral (mean 3.77 / 5).
- AI explained answers in a way they could understand: 64% agreed or strongly agreed and 14% were neutral (mean 3.55 / 5).
- AI helped them learn, not just finish: 59% agreed or strongly agreed and 7% were neutral (mean 3.55 / 5).
- Students would use the AI tutor again: 55% agreed or strongly agreed overall and 36% were neutral (9/13 would use again, mean 3.69).
- Most common uses: explaining a concept (59%), checking whether they were on the right track (45%), debugging code (36%), brainstorming ideas (32%), and getting unstuck when the teacher was unavailable (32%).

Impact on Student Learning Processes

The clearest gains in this course were in how students used the AI to further enhance their own learning. Two things changed for learners:

1. Students Got Help in the Track That Matched Their Goals

The AI was able to identify which track a student was working in by inferring the track from the language or questions the student used; the support each student received looked different. A Business Track student asking about “using AI to forecast sales” received guidance on



framing a business problem, choosing relevant data, and interpreting results in business terms. A Creative Track student who asked about the same underlying idea received creative-focused guidance on user experience, prompt design, and how the AI feature would feel inside a product. A Computer Science Track student received guidance on model choice, code structure, and evaluation metrics, emphasizing programming. Students stopped feeling that the course was “too technical” or “not technical enough” because the support genuinely matched their interests and current skills.

2. Help Arrived While the Work Was Still in Front of Them

Because the AI was always available, students could ask a question the moment they got stuck and could keep working, rather than parking the question and the learning task for the next day. This shortened the loop between confusion and resolution from days to minutes. In an end-of-course survey of 30 student responses across both platforms, 64% of students agreed or strongly agreed that the AI tutor helped them move forward when they got stuck, and 59% agreed or strongly agreed that it helped them learn rather than just finish the project.

Impact on the Teacher

The teacher's role shifted from being the sole source of just-in-time answers to being the designer of a learning environment. In this environment, the AI handled most routine questions while the teacher concentrated on coaching, project feedback, and the conceptual reteaching that AI cannot do well. That shift to employing an AI tutor didn't make the teacher's instructional design less important; it gave the

teacher more time to refine and improve the instructional design. With the AI handling track-specific Q&A in real time, the teacher could circulate, observe student work, and intervene where it mattered most. The teacher remained fully responsible for curriculum decisions, grading, and the accuracy of the AI tutor's content knowledge—by listening to student conversations during class and refining the AI tutor's instructions and examples for each track.

What It Took to Set Up

The teacher began by writing track-specific content—curriculum outlines, key vocabulary, sample projects, and rubric language—for the Business, Creative, and Computer Science Tracks. These briefs were loaded into a single AI system as its content knowledge base, along with explicit instructions on how to identify which track a student was on and how to tailor responses. Just as critical as the AI tutor itself was the surrounding assignment design: the teacher built phased lab write-up templates for each track that required students to record their rationale and justification at every step of the project and structured the course so students would present their final deliverable to the class at the end of the year with open Q&A from peers and the teacher. It was this instructional design that ensured students could not earn a strong grade by relying on AI alone. The teacher explained,

“I want my students to understand that in the real world, multiple disciplines work together to fulfill a goal, which is why I designed multiple tracks that students can choose to specialize in. It is a delicate and complex curriculum design, and without the AI ... to carry some of the work in supporting student learning, I would not have been able to pull it off as smoothly. ... I know I am perhaps pushing



the envelope a little when it comes to differentiated instruction and student-choice learning. So many so-called differentiated lesson plans I looked at either add differentiation as an afterthought or veil ability tracking in the form of differentiated instruction. My ambitious idea of a true student-choice, differentiated [course with] conceptual rigor becomes that much more achievable, augmented with the use of the AI ... as though I have a dedicated teaching assistant."

Challenges and Friction Points

Track Drift

Several students reported that the AI occasionally pulled in information meant for another track. One Creative Track student noted that the tutor “would give me information not only for my track but for the business and programming track as well,” requiring her to filter the response down to what was relevant. Another Creative Track student observed that the AI tutor sometimes drifted into related-but-unrequested visuals—for instance, going on a tangent about the history of color theory when asked about color palettes. Students generally handled this by re-stating their track in the prompt or by re-prompting with more specific constraints; the teacher addressed it by tightening the tutor’s track-identification instructions as patterns of drift emerged. Though somewhat problematic, these errors aided the teacher in knowing that the students were engaged and being critical consumers.

AI Errors and Outdated Information

The tutor occasionally gave answers that were incorrect or out of date, particularly

The tutor occasionally gave answers that were incorrect or out of date, particularly for the Computer Science track where libraries and application programming interfaces (APIs) change quickly. The teacher addressed this by reviewing flagged student and AI conversations, by teaching students to verify code suggestions before running them, and by updating the tutor's instructions when specific errors recurred. In the survey, 55% of students agreed or strongly agreed that the AI tutor “sometimes gave answers I needed to check or question,” and several wrote about catching errors firsthand. Rather than discouraging engagement, these moments reinforced the importance of staying actively involved in the learning process.

Students were also taught how to effectively evaluate the support the AI provided by checking its responses against their own work and other sources. A Computer Science Track student described asking about a file-directory issue and getting a confusing answer; he switched to a different tool and concluded, “Some AI models may not be entirely reliable when it comes to explanations.” A Business Track student noticed that the AI agreed with her market assumptions “immediately” and cited no sources. The experience taught her to challenge the AI tutor's answers rather than take agreement as confirmation. A Creative Track student described iterative debugging where the tutor would “convert the code back to how it was” on each new prompt, requiring her to start from scratch. Students consistently reported that these failures taught them to verify outputs against another source, ask the tutor to cite where its information came from, and treat the tool as a starting point rather than provider of the final answer.



Student Trust and Over-Reliance

The teacher also set explicit norms for how students were to work with the AI tutor: distinguish appropriate from inappropriate uses of AI in academic contexts; maintain authenticity in their own tasks and artifacts when using AI; develop sound fact-checking, verification, citation, and disclosure practices for AI-generated content; and recognize misleading or unreliable outputs. Together, these norms framed the AI as a support that had to be checked and credited rather than a shortcut for thinking and finishing work. Together, the writeups, the presentation, and the norms reflect a broader point. AI produces meaningful learning only inside a curriculum deliberately built to demand higher-order thinking from students. The AI is a support; the assignment design is what makes the support pay off.

Family-Facing Assurances



Student conversations with the AI are reviewed by the teacher and used to improve instruction; they are not shared beyond the classroom.



The AI is a learning support tool only; the teacher remains responsible for curriculum, instruction, assessment, and final grades.



Students are taught to verify AI responses, not to accept them blindly, which is an explicit course learning outcome.

Scaling and Policy Alignment

Although this implementation occurred in a single computer science CTE course, the core approach—a teacher-built AI tutor with track-specific content knowledge—is adaptable across any CTE program that serves students with multiple career interests inside the same course. Business education, design and digital media, engineering, and health sciences all routinely combine students with different post-graduation goals. Schools can establish guidelines for teacher-built AI tutors that maintain teacher authority over curriculum content and final grades. AI tutor use remains subject to existing data privacy, instructional quality, and academic integrity policies.

Recommendation for Education Leaders

Support teacher-built AI tutors: Provide time and training for CTE teachers to load their own curriculum into AI tools rather than rely on generic chatbots.

Invest in instructional design, not just the tutor: The benefits of an AI are limited without purposefully designed curriculum and assignments that demand higher-order thinking—step-by-step justifications, peer-facing presentations, and graded reasoning artifacts that a chatbot alone cannot produce for the student.

Design for multiple tracks intentionally: Where a CTE course serves students with different career goals, treat track-specific support as a core requirement, not an afterthought.



Maintain teacher authority: State clearly in policy that AI is an instructional support and that teachers make all final decisions on curriculum, assessment, and grades.

Measure learning, not just usage: Track whether students on each track produce stronger work and demonstrate stronger reasoning. That is the real return on investment, not the number of tutor sessions logged.

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Why This Matters Now

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References

- Belland, B. R., Walker, A. E., Kim, N. J., & Lefler, M. (2017). Synthesizing results from empirical research on computer-based scaffolding in STEM education: A meta-analysis. *Review of Educational Research*, 87(2), 309–344. <https://doi.org/10.3102/0034654316670999>
- Díaz, B., & Nussbaum, M. (2024). Artificial intelligence for teaching and learning in schools: The need for pedagogical intelligence. *Computers & Education*, 217, Article 105071. <https://doi.org/10.1016/j.compedu.2024.105071>
- Deng, R., Jiang, M., Yu, X., Lu, Y., & Liu, S. (2025). Does ChatGPT enhance student learning? A systematic review and meta-analysis of experimental studies. *Computers & Education*, 227, Article 105224. <https://doi.org/10.1016/j.compedu.2024.105224>
- Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation practices: A systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educational Research Review*, 24, 31–54. <https://doi.org/10.1016/j.edurev.2018.02.002>
- Fan, Y., Tang, L., Le, H., Shen, K., Tan, S., Zhao, Y., Shen, Y., Li, X., & Gašević, D. (2025). Beware of metacognitive laziness: Effects of generative artificial intelligence on learning motivation, processes, and performance. *British Journal of Educational Technology*, 56(2), 489–530. <https://doi.org/10.1111/bjet.13544>
- Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environments*, 11, Article 28. <https://doi.org/10.1186/s40561-024-00316-7>



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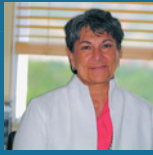
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