



Instructional AI:

Education's Best
Kept Secret



Foreword



In my work with educators across dozens of institutions and organizations, I've observed a striking paradox: while we're two years into the "ChatGPT revolution," many pedagogical communities still don't have clarity about AI's role in education, despite its power and inevitability. The conversations still often center on defense and restriction rather than opportunity and integration. This reactive stance misses a lot, including a crucial point: AI in education isn't new. What's new are its capabilities and accessibility. The fundamental questions remain the same as with any educational technology:

How does it enhance learning? How does it empower educators? And most importantly, how does it serve our pedagogical goals rather than replace them or create shortcuts?

For institutions and educators navigating this rapidly evolving landscape, the path forward requires neither wholesale adoption nor blanket prohibition. Instead, we need discernment—the ability to distinguish between AI tools that undermine educational goals and those that

advance them, as well as the ability to distinguish AI-inclusive and AI-exclusive contexts. This eBook provides a valuable framework for making those distinctions and implementing AI in ways that truly benefit students and educators alike. The examples showcased here demonstrate that when AI is purposefully designed for education, it can help address longstanding challenges in teaching and learning while preserving the (currently?) irreplaceable human dimensions of education.

I encourage readers to approach these ideas with an open mind, recognizing that how we integrate AI into education today will shape the learning experiences of generations to come.



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Experience AI Yourself

Before diving into the details of Instructional AI, let's take a moment to **experience AI's capabilities firsthand**. The best way to understand AI's potential is to see it in action. Below is a **prompt** designed to generate a **customized summary** based on your role, level of education, and interests. Open up your favorite AI tool like ChatGPT or Claude, attach this PDF and input the following prompt while filling out the relevant information:

I am a [your role] working in [K-12 education/higher education/other].
I am interested in learning about [specific AI topic: e.g., academic integrity, student engagement, AI-driven feedback, grading automation].
I am attaching an ebook published by Packback on Instructional AI, please summarize the most relevant insights about Instructional AI for someone in my position. Additionally, provide practical ways I can apply AI in my field.



What is Instructional AI?

Instructional AI is artificial intelligence that tutors students by teaching them concepts and skills but does not do the critical thinking or writing for the students. Instructional AI enables new forms of student interaction, helps educators address variability in student learning, supports powerful forms of adaptivity, enhances feedback loops, and helps support educators.

Instructional AI consists of three unique principles or elements that support institutional initiatives and work in tandem to drive student outcomes and support educators.



AI as a tutor



Rooted in educational methodology



Educator amplification not replacement

Using Instructional AI as a Tutor

Artificial intelligence is no longer the future of education—it’s the present. As AI tools continue to gain popularity and reshape the way education is done, it’s paramount that we thoughtfully integrate AI into education and to ensure that we are using Instructional AI as a tutor to guide students, not as a shortcut for individual thought or output.

When AI Becomes a Shortcut

Studies show that the impact of AI in education heavily depends on its implementation. A study ([Bastani, et al., 2024](#)) found high school students using unguided AI tools like GPT-4 performed 17% worse on exams, as they used AI as a crutch, bypassing problem-solving. However, in university programming courses ([Lehmann, et al., 2024](#)), students who actively engaged with AI for idea generation and coaching saw significant learning improvements, while those who used it to complete exercises developed an “illusion of competence” and deteriorated foundational skills.

The Atrophy of Critical Thinking

AI overreliance doesn’t just impact test scores—it weakens critical thinking. A recent study ([Lee et al. 2025](#)) describes this as an “automation paradox”: by offloading cognitive effort to AI, students lose opportunities to build and refine their reasoning skills, leaving them unprepared for real-world problem-solving.

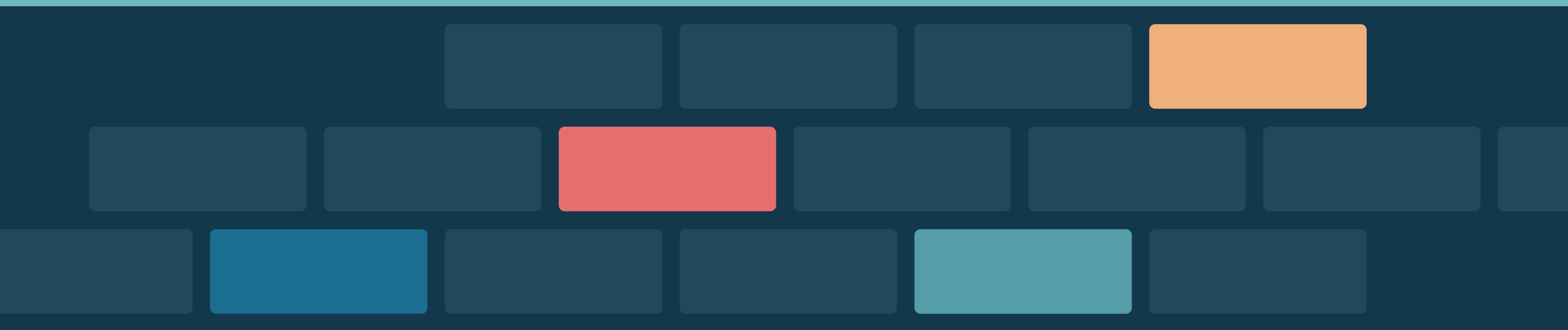
Guiding Students, Not Replacing Thinking

When implemented correctly, Instructional AI can enhance learning rather than undermine it. A study on AI in active learning ([Kestin et al. 2024](#)) found that students using an AI tutor designed with active learning principles learned twice as much in half the time compared to those in traditional instructor-led courses. The key? The AI guided students through problem-solving rather than providing direct answers.

The Responsibility to Choose Wisely

AI’s role in education is not neutral. Poorly designed AI tools create dependency and passive learning, but thoughtfully engineered Instructional AI tools that act as a tutor, can foster engagement, mastery, and deep learning. Institutions must critically evaluate AI solutions, choosing partners that prioritize pedagogical alignment over convenience.

The future of AI in education isn’t about replacing human instruction—it’s about reinforcing the learning process.



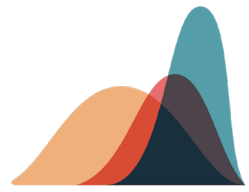
AI Built Upon Sound Pedagogical Foundations

Further supporting Instructional AI's ability to enhance student outcomes, strengthen educator impact, and level the playing field for all is the fact that it is rooted in established educational methodologies and psychological frameworks.

In this section we will focus on two foundational theories:

- Bloom's 2 Sigma Problem
- Self-Determination Theory

These frameworks provide the most impactful insight into how Instructional AI can enhance learning outcomes, increase student motivation, and amplify educator impact.



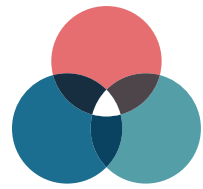
The Answer to Bloom's 2 Sigma Problem

In 1984, educational researcher Benjamin Bloom identified what is now known as the **2 Sigma Problem**: students who received **one-on-one tutoring** outperformed those in traditional classrooms by **two standard deviations (2 sigma)**, meaning they achieved higher learning gains than 98% of their peers in conventional settings. Unfortunately, given the lack of resources and time that plagues many of today's educators and institutions, this problem has largely remained unsolved. AI however, now offers us a potential solution to this decades old problem.

Recent studies, like those done by [The University of Iowa](#) and [The University of Chicago](#), suggest that Instructional AI-powered tutoring can bridge this gap, making personalized feedback accessible to all students. When designed with these pedagogical principles in mind, Instructional AI can provide:

- **Adaptive learning experiences** tailored to each student's needs.
- **Instant feedback and scaffolding** that mirrors high-quality tutoring.
- **Guided problem-solving approaches** that reinforce deeper learning rather than rote memorization.

[A meta-analysis by Kulik & Fletcher](#) found that computer-based tutoring systems improved student performance by an average of 0.79 sigma, meaning AI-driven tutoring has the potential to close nearly 40% of the gap identified by Bloom's research. When implemented correctly, Instructional AI-powered tutoring can bring students closer to the benefits of real-time, one-on-one instruction, driving significant improvements in comprehension, student retention, and outcomes.



Self-Determination Theory: The Key to Motivation and Engagement

Competence

(Mastery) – Students must feel capable of achieving success. Instructional AI fosters this by providing real-time, constructive feedback, allowing students to develop confidence in their abilities.

Autonomy

(Ownership of Learning) – Learners need agency in their educational journey. Instructional AI-driven tools empower students by guiding them through decision-making rather than simply providing answers, encouraging independent problem-solving and promoting higher levels of critical thinking.

Relatedness

(Connection to Others & Learning) – Learning is social, and students perform better when they feel connected to their educators and peers. Instructional AI can help by reducing administrative burden on educators, allowing them to spend more time engaging with students directly, increasing their impact and effectiveness.

Instructional AI effectively applies the three core principles of SDT to enhance student outcomes and engagement. By placing students in control of their learning and encouraging them to ask insightful questions, it cultivates a sense of autonomy and intrinsic motivation. This inquiry-based approach, combined with AI-driven personalized feedback, supports mastery and continuous improvement, ultimately connecting learning to each student's individual goals.

Using AI to Enhance Educator Impact

While AI's impact on students is a key focus, its effect on educators is equally vital. AI should enhance teaching, not simply streamline it. Many AI tools automate tasks but often miss strengthening the educator-student connection. This oversight risks AI becoming mere automation, increasing speed without necessarily impact or engagement.

Moving Beyond Efficiency to Impact

Beyond mere efficiency, Instructional AI transforms teaching effectiveness. It enhances educators' roles by improving feedback, deepening engagement, and fostering stronger student-teacher relationships. By alleviating administrative burdens, AI allows educators to prioritize connecting with students, guiding critical thinking, and creating authentic learning experiences. As a Central Michigan University podcast, "[AI and Education](#)," emphasizes, this shift enables educators to amplify their reach and impact, positioning Instructional AI as an enabler for deeper engagement rather than a replacement.

Some of the themes touched on include:

- **Personalized, Nuanced Feedback at Scale:** Instructional AI analyzes student work for deeper insights, amplifying human feedback and freeing educators for higher-order guidance.
- **Creating More Meaningful Student Engagement:** Real-time AI feedback allows for student iteration and makes grading a constructive process.
- **Supporting Student-Instructor Interaction:** AI-powered tools facilitate structured communication, ensuring timely guidance and clarification for students.

Bringing Educators Closer to Their Students

While generative AI tools can and do have a place in education, they come with the inherent risk that they can increase the distance between educators and students by automating too much.

Instructional AI when used correctly allows educators to:

- **Spend more time on direct instruction and student mentoring** instead of being overwhelmed by grading and paperwork.
- **Provide actionable, content-specific feedback** rather than just mechanical corrections.
- **Encourage student-driven learning** while maintaining a **human-centered educational experience**.

As AI continues to shape the educational landscape, institutions must consider not only how these tools impact students but also how they empower educators. **The goal of Instructional AI is not to replace the educator, but to extend their reach, enhance their insights, and strengthen their connection to students.**

Instructional AI Case Studies

At the outset of this eBook, we posed a fundamental question:

How do we improve academic outcomes with the use of AI, and how do we increase the effectiveness of instructors with the use of AI?

As we've explored, we've found that the answer lies in a pedagogically grounded approach that prioritizes student learning, instructor empowerment, and institutional effectiveness. However, theory alone is not sufficient. To truly understand the transformative potential of Instructional AI, we must examine its impact in real-world educational settings.

The following case studies provide real-world examples of Instructional AI in diverse settings. They show the advantages of AI-driven tutoring, personalized feedback, and adaptive models, offering a new perspective on how AI addresses challenges faced by students, educators, and institutions.

CASE STUDY

Packback - An Instructional AI-Driven Writing Tutor

Problem

Writing assignments are challenging for both students and educators. Students often struggle with structuring arguments, using credible sources, and improving their mechanics—especially without timely, actionable feedback. Educators face an overwhelming workload when grading long-form writing, and traditional methods delay the feedback students need to grow. This gap leaves students under-supported and instructors stretched too thin to provide meaningful guidance.



Solution

To address these challenges, Packback introduced **Deep Dives**,[?] an AI-powered writing platform designed to support both students and instructors. For students, Deep Dives offers real-time, personalized feedback on various aspects of writing, including grammar, structure, and research quality. For instructors, the platform provides AI-assisted grading tools that streamline the evaluation process, allowing educators to focus more on content and less on mechanics.

Core Features of Packback Deep Dives:

- **AI-Powered Writing Tutor:** Delivers instant feedback on grammar, mechanics, structure, and depth, enabling students to refine their work before submission.
- **Research Quality Assessment:** Evaluates the credibility of sources and ensures proper citation formats, fostering academic integrity.
- **Grading Assistant:** Offers AI-suggested scores for writing mechanics and customizable rubrics, reducing grading time and enhancing consistency.

Results

A comprehensive study conducted during the Fall 2022 semester revealed significant positive outcomes from the implementation of Deep Dives:

- **Improved Student Grades:** There was an 11% increase in final grades
- **Enhanced Writing Confidence:** Approximately 65% of students reported feeling confident in their writing abilities, a 55% increase from prior confidence levels.
- **Reduced Grading Time:** Instructors experienced a 30% reduction in grading time per essay
- **Increased Instructor Satisfaction:** There was an 89% increase in instructors reporting satisfaction with the quality of student writing

CASE STUDY

U.S. NSF National AI Institute for Student-AI Teaming (iSAT)

Problem

Traditional classroom environments often struggle to provide personalized learning experiences that engage all students equally. Educators face challenges in supporting diverse student needs while fostering collaboration and critical thinking. Without scalable solutions, classrooms remain limited in their ability to provide tailored support that encourages deep learning and student autonomy.

Solution

The [U.S. NSF National AI Institute for Student-AI Teaming \(iSAT\)](#) leverages AI-powered instructional tools to enhance student collaboration and engagement. By incorporating AI as an active participant in group discussions and problem-solving exercises, iSAT enables a more personalized and adaptive learning environment. These AI-driven systems provide real-time feedback, guide students through complex concepts, and support educators in facilitating interactive and meaningful learning experiences.

Results

- Increased student engagement and participation in collaborative learning activities
- Improved academic performance through AI-facilitated scaffolding and feedback loops
- Enhanced educator effectiveness by reducing administrative burden and allowing for deeper pedagogical focus

CASE STUDY

SmartSchool - AI-Powered Math & STEM Learning

Problem

Math education presents a unique challenge: students often struggle with foundational concepts that must be mastered before progressing to more advanced topics. In traditional classrooms, educators have limited time to diagnose learning gaps, provide individualized feedback, and offer timely intervention. Many students either **rely on guesswork** when solving problems or become discouraged when they cannot immediately find the correct answer. Furthermore, grading handwritten math assignments is a time-consuming process, delaying crucial feedback that could help students course-correct before misconceptions become ingrained.

Solution

SmartSchool is an AI teaching assistant tailored specifically for math educators. Unlike generic AI-powered learning tools, SmartSchool is designed to assess the student's thought process, not just the final answer. Its core features include

- **Instant Grading:** Real-time grading of handwritten math, freeing educators from manual work.
- **Personalized Feedback:** Customized insights into errors, focusing on *why* and how to fix them.
- **AI-Powered Coaching:** Guides self-correction, prompting students to identify their own errors.
- **Encouraging Productive Struggle:** Fosters problem-solving persistence, discouraging reliance on quick AI answers.

Results

- **25% improvement** in problem-solving accuracy among students using SmartSchool for math instruction
- **40% reduction** in student dropout rates in introductory STEM courses
- **35% increase** in student engagement
- **50% reduction** in grading time for teachers

Conclusion

The Impact of Instructional AI in Real-World Learning Environments

The case studies presented demonstrate how Instructional AI can be deployed in various ways across various disciplines. From using Packback to improved writing and critical thinking, to enhancing collaborative problem-solving through iSAT, to revolutionizing math instruction with SmartSchool, each example underscores a common theme: when AI is used as a tutor, designed with education in mind, and enhances the impact of the educator, it can drive meaningful learning outcomes.

As institutions consider the role of AI in education, the choice is clear—thoughtfully implemented Instructional AI is not just a tool for efficiency, but a catalyst for deeper learning, stronger educator-student connections, and long-term academic success.

Ready to transform learning at your institution?

Speak with a Packback team member today and see how Instructional AI can empower your educators and students.

To learn more about Packback, visit packback.co or email us at curious@packback.co.