

A Human-AI Hybrid Co-Design Model: Planning Effective Instruction with ChatGPT

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Abstract: This article explores the integration of ChatGPT into instructional design, utilizing a backward planning framework to align learning objectives, assessments, and activities for enhanced educational outcomes. Grounded in the principles of Understanding by Design (UbD) the paper introduces a three-step human-AI hybrid co-design model that enables educators to streamline planning processes while maintaining pedagogical rigor. This manuscript demonstrates how generative AI can support the creation of transfer goals, performance tasks, and authentic learning experiences, providing detailed prompts and examples applicable to both K-12 and higher education settings. Findings from five preliminary evaluation studies with over 500 participants highlight the model's adaptability across diverse educational contexts, with teachers reporting improved alignment, creativity, and efficiency in lesson planning. Participants also emphasized the importance of iterative feedback and foundational AI knowledge for maximizing the benefits of the co-design process. The model empowers teachers to implement evidence-based practices by focusing on alignment and real-world relevance, fostering meaningful student engagement and knowledge transfer. Additionally, the article addresses potential limitations, such as the need for foundational AI literacy and instructional planning skills, and proposes strategies for effective application across diverse educational contexts. This work contributes to the growing field of AI-assisted pedagogy by offering a practical guide that balances the scalability of AI with the critical insights of human expertise.

Keywords: ChatGPT in education, AI-assisted design, lesson planning with AI, Understanding by Design, backward planning, AI-enhanced instructional design, backward design, AI-powered lesson plans, plan with ChatGPT, performance task

Highlights

What is already known about this topic:

- Co-design approaches enhance collaboration and adaptability in educational innovation.
- AI-assisted lesson planning requires human oversight to ensure contextual relevance and pedagogical rigor

What this paper contributes:

- Introduces a structured co-design model integrating ChatGPT for scalable lesson planning.
- Demonstrates the adaptability of AI-supported planning across various contexts.
- Provides preliminary evidence from five evaluation studies, involving over 500 educators, showcasing effectiveness and challenges.

Implications for theory, practice and/or policy:

- Validates the potential of human-AI collaboration to streamline instructional design while maintaining pedagogical standards.
- Highlights the importance of AI literacy and prompt engineering in professional development for educators.

Introduction

In recent years, generative artificial intelligence (AI) tools like ChatGPT have rapidly transformed the educational landscape, presenting new opportunities for K-12 teachers and higher education faculty/instructors to enhance instructional design. Teachers and instructors are leveraging AI not only to streamline lesson planning but also to create engaging content and assessment tools, often finding efficiency in generating examples, explanations, and resources for active learning (Chou et al., 2024; Farrelly & Baker, 2023). Studies, such as those by Keppler et al. (2024), have identified primary uses of AI in classrooms: *as a tool* to generate outputs like quizzes and worksheets, *as an aid* for instructional planning, or *as a blend of both*. These uses illustrate the potential of AI to assist educators with routine tasks, freeing up time for personalized interactions and deeper pedagogical planning.

These uses address immediate instructional needs and have the potential to support a broader range of advanced, research-backed instructional designs that are often challenging to create due to the time, effort, and professional development required (Chiu & Rospigliosi, 2025). AI acts as a “force multiplier,” enhancing teachers’ ability to implement evidence-based methods while retaining control over instructional quality (Mollick & Mollick, 2023, p. 2). For instance, AI tools can generate multiple examples, varied explanations, and low-stakes assessments, which support evidence-based techniques like retrieval practice and formative assessment. However, despite the growing presence in using ChatGPT for content generation, current AI-assisted efforts are not typically aligned with instructional frameworks and models. Recent studies introduce frameworks for AI use in education but lack connections to pedagogical models (e.g., Su & Yang, 2023). They often function as isolated content generators rather than as collaborators in coherent, outcome-driven instructional planning. Moreover, although many educators are experimenting with prompt engineering, few models exist that scaffold this process within a pedagogical workflow (Knoth et al., 2024) and teachers still lack structured, replicable models that guide them in co-designing instruction with AI in a pedagogically sound way (Walter, 2024). For example, Selvakumaran et al. (2024) explore prompt engineering in curriculum design and proposed GPT-4 Co-Designed Curriculum Framework, but pedagogical alignment is underexplored. Despite the promise of generative AI, there remains a lack of structured models that integrate AI tools (Chiu, 2024) and prompt engineering into widely accepted instructional frameworks (Knoth et al., 2024) for meaningful, cohesive learning experiences (e.g., Wiggins & McTighe, 2005). This article addresses this gap by offering a structured model that aligns AI outputs with pedagogical intentions.

A significant issue about the lack of human oversight in using AI for instructional purposes also emerges. Most current frameworks overlook how teachers can meaningfully shape, critique, and refine AI-generated content in real-time to ensure instructional relevance. The collaboration between human educators and AI systems presents unique challenges not adequately addressed by existing models (Chiu & Rospigliosi, 2025). These include issues related to power dynamics, transparency, and the integration of AI-generated content into human-centric educational designs (e.g., Nikolopoulou, 2024). One of the most pressing gaps is the absence of structured processes for real-time human-AI negotiation during lesson planning. Current models often treat the AI as a passive tool rather than a co-creative partner, leading to a one-directional workflow that limits teacher agency (Tian, 2023). Moreover, teachers frequently lack the training to critically evaluate or adapt AI outputs in alignment with learning goals and pedagogical values (Chounta et al., 2022). Studies have also shown that without frameworks that scaffold the interaction, educators may either underutilize AI capabilities or over-rely on its outputs, resulting in generic, misaligned lesson components (Lyu et al., 2025). To directly address these challenges, this article introduces a human-AI hybrid co-design model that emphasizes pedagogical alignment, teacher agency, and real-time collaboration. Despite the growing use of generative AI in education, there remains a lack of structured, theory-informed models that show teachers how to co-design instruction with AI in a way that maintains pedagogical rigor and supports real-world learning transfer. Existing approaches often rely on ad hoc prompt engineering, automation, or content generation, rather than bridging AI capabilities with established frameworks like Understanding by Design (UbD) (Wiggins & McTighe, 2005). The proposed model positions teachers as active instructional designers who collaborate with AI to align goals, assessments, and activities for meaningful learning. It also offers a replicable process for integrating ChatGPT into diverse subject areas and educational settings.

While AI can significantly streamline certain instructional processes, its effectiveness ultimately depends on thoughtful integration with established pedagogical frameworks. To ensure that AI serves as a meaningful support rather than a crutch, educators must carefully balance its use with human insight

and professional judgment, particularly when designing complex learning experiences (Chiu, 2025). Numerous practical guides and resources have been published on incorporating AI into teaching and course design (e.g., Mollick & Mollick, 2023), yet many focus primarily on single-use applications rather than comprehensive instructional design approaches. Despite their potential benefits, previous AI-assisted instructional guides have faced criticism for overemphasizing AI's role in the classroom, sometimes risking teacher over-reliance on AI-generated materials and neglecting essential human elements like empathy and professional judgment (Chiu & Rospigliosi, 2025). Instructional resources designed with a balanced, human-AI hybrid, collaborative approach can mitigate these concerns, emphasizing the role of the teacher as an active participant in refining AI-generated outputs to suit specific educational contexts (Cukurova, 2024). This human-centered, iterative approach fosters a responsive alignment of instructional elements, ensuring that AI supports educators in enhancing the depth and relevance of student learning experiences. Therefore, the main purpose of this article is to provide a practical, theory-informed guide to leveraging ChatGPT in instructional design, using a backward planning approach that aligns learning objectives, assessments, and activities. By presenting prompts, examples, and structured design strategies, this guide will demonstrate how ChatGPT can serve as an effective codesign partner, empowering educators to enhance student engagement, foster transfer of learning, and integrate authentic assessment seamlessly into their teaching practice.

Literature Review

This section reviews the current body of literature on AI-assisted instructional design tools and emerging human-AI collaborative models. It is organized into two thematic areas: (1) practical guides and design strategies involving chatbots, and (2) hybrid co-design frameworks that emphasize meaningful teacher-AI collaboration.

AI-assisted Guides and Practical Work on Design with Chatbots: There are generally two forms of AI-driven instructional guides available. The first type allows AI to generate content with minimal human input, often lacking integration with established pedagogical approaches. The second type involves the application of pedagogical strategies but limits or omits the teacher's active role in the instructional design process, reducing opportunities for meaningful human-AI collaboration.

Mollick and Mollick (2023), in their work titled "Using AI to Implement Effective Teaching Strategies in Classrooms," explore how AI can enhance teaching by making evidence-based strategies more accessible and manageable for instructors. The authors present five impactful strategies to significantly improve student learning, including addressing misconceptions and utilizing frequent low-stakes testing. They emphasize the potential of AI as a "force multiplier" for educators, provided it is used thoughtfully. While it presents valuable insights, the article could promote an overreliance on AI tools, potentially undermining the role of the teacher/designer/instructor. The effectiveness of teaching often hinges on human interaction, empathy, and understanding of student needs, which AI may not fully replicate without an expert voice or intervention. In addition, there is a lack of a systematic approach to instructional design, which is relevant for effective instruction when integrating AI tools. Effective instructional design typically follows established models (like ADDIE or SAM) that guide educators through analysis, design, development, implementation, and evaluation. Ideally, a systematic instructional design process ensures that teaching strategies align with specific learning objectives. If a guide does not emphasize this alignment but only focuses on strategy, teachers/instructors may implement AI tools that do not effectively support their educational goals, potentially leading to confusion. Therefore, without such a framework, instructors may struggle to effectively incorporate AI into their teaching practices.

In their book, Bowen and Watson (2024) emphasize the significant opportunities AI offers, from facilitating interactive learning and creative assignments to redefining academic integrity. The authors advocate for an innovative approach where AI fosters creativity, helping students move beyond traditional learning boundaries. They also encourage the idea of viewing AI as a collaborative resource that enhances, rather than replaces, the learning experience. While the book provides examples of AI-generated prompts, it does not always address the depth of scaffolding required to guide students through complex concepts. Effective instructional design often involves iterative stages, yet some AI-generated activities lack detailed scaffolding. As a result, teachers may need to further modify or supplement these prompts to ensure they provide adequate support for all learners, especially in differentiated classrooms. Moreover, the book emphasizes generating assignments and activities using

AI but offers limited guidance on integrating these prompts into a cohesive assessment framework. Effective instructional design requires seamless integration of formative and summative assessments with learning activities, yet there's little exploration of how AI-generated prompts can be tailored to fit various assessment methods. Teachers may find that they need to adapt these prompts extensively to maintain alignment with assessment criteria and learning outcomes.

Keppler et al., (2024), in their study titled "Backwards Planning with Generative AI," emphasize the integration of generative AI into the backward planning process utilized by U.S. K-12 teachers. In this context, generative AI serves as a tool that helps teachers craft their lesson plans and instructional strategies. A couple of critical points must be highlighted in terms of how the use of AI and backward planning. The study primarily focuses on the use of generative AI for creating outputs, such as worksheets and quizzes, but does not explore how AI can assist in the initial stages of backward planning, such as setting learning objectives or assessing student needs. While the paper highlights productivity gains for some teachers using AI, it raises concerns about over-reliance on AI-generated materials. This dependence could lead to a lack of critical engagement with the content and diminish teachers' professional judgment in crafting personalized learning experiences. The paper mentions that some teachers found AI-generated materials usable, while others faced challenges with the outputs not meeting their specific needs. This inconsistency raises questions about the reliability and quality of generative AI in educational contexts, suggesting that further work in terms of practical and research aspects is needed to evaluate the effectiveness of AI-generated resources.

There are other studies, works, and practical guides on similar topics (e.g., Jungherr, 2023). However, these guides often focus on single-use or prompt-driven activities without a sustained, systematic approach that fully aligns learning goals, assessments, and instructional strategies. Effective instructional design should integrate these elements cohesively, as recommended by alignment principles that guide the constructive alignment of objectives, assessments, and strategy (Wiggins & McTighe, 2005). Many of these publications fall short by not offering a structured, iterative approach for educators to connect and refine AI-generated prompts within a broader learning context. A more robust human-AI hybrid co-design approach would allow for adaptive, personalized, and contextually relevant instructional design that could transform traditional limitations into innovative, meaningful educational practices (Cukurova, 2024).

These critiques emphasize the need for a dynamic, iterative design framework that leverages both human creativity and AI's scalability, ultimately ensuring a more responsive alignment across the core instructional design components, highlighted in publications, such as in foundational frameworks like the ADDIE model, addressing instructional design in AI contexts (SkillQ, 2024), in an interactive GenAI tool that utilizes a comprehensive "interactive mega-prompt" system to generate personalized lesson plans (Karpouzis et al., 2024), 5E instructional model-informed AI chatbot (Bai et al., 2024), and in "LessonPlanner" which generates adaptive content based on Gagne's nine events (Fan et al., 2024). This approach could better support educators in adapting AI to meet varied learning needs and contexts effectively.

Human-AI Hybrid and Collaborative Design Approach: A growing body of research has begun to explore the collaborative potential of human-AI interaction in instructional design, with an emphasis on iterative and hybrid approaches. Chounta et al. (2022) discuss the need for models that support human-AI co-creativity, emphasizing how collaboration between teachers and AI tools can lead to more innovative and effective educational practices. However, they note that much of the current work lacks clearly defined scaffolds for managing this partnership, leaving teachers unsure of how to effectively engage with AI. Similarly, Cukurova (2024) argues for more structured frameworks that facilitate teacher agency during the AI-assisted design process. His work emphasizes that co-design requires continuous negotiation between human and machine, and that this process must be guided by pedagogical principles rather than technological capabilities alone. Without this, the risk remains that AI-generated outputs will either dominate or be underutilized, failing to reflect the nuanced needs of real-world classrooms. Tian (2023) adds to this discussion by identifying a critical issue in current practices: AI is often treated as a passive tool rather than a co-creative partner. This one-directional workflow limits teacher input and can stifle personalization. Lyu et al. (2025) further reinforce this point in their mixed-methods study, showing that while instructors appreciate AI's efficiency, they often distrust its pedagogical appropriateness without human adaptation. Their findings suggest that meaningful integration of AI into instructional design depends heavily on teacher training and structured collaboration models.

Recent studies and research calls on human-AI collaboration collectively emphasizes the need for intentional design in human-AI partnerships that go beyond content generation to promote shared agency, multifaceted roles teachers can play, and pedagogical alignment. According to Chiu and Rospigliosi (2025), teacher–AI collaboration is most effective when educators take on active roles as reviewers and facilitators, critically examining students’ interactions with AI to surface assumptions, risks, or hallucinations. As learning designers and enhancers, teachers can adapt AI-generated content to better align with broader learning goals and student interests. In more operational roles, the authors (2025) suggested, as strategists and data analysts, teachers use AI-generated analytics to diagnose learning trends and tailor instruction accordingly. These emerging roles emphasize that AI should not replace teacher expertise but rather augment it through dynamic, informed human oversight. From another perspective, Jain et al. (2023) provide a broader framework for human–AI work design, highlighting the importance of collaboration structures. Their study shows that sequential collaboration, where teachers follow AI suggestions without contributing, can reduce trust and clarity. In contrast, specialized, parallel roles—where both AI and humans contribute distinctively—foster better outcomes. This insight supports the intentional design of the proposed co-design model, which keeps teachers in control and treats AI as a collaborative assistant. Without clear task division and iterative feedback, AI-human teamwork risks diminishing teacher agency and instructional quality.

In addition, emerging tools such as Karpouzis et al.’s (2024) interactive mega-prompt system and Fan et al.’s (2024) LessonPlanner application attempt to bridge this gap. These tools are designed to support a more responsive, teacher-driven interaction with AI. Bai et al. (2024) present an AI chatbot informed by the 5E instructional model, enabling real-time support that aligns with inquiry-based science instruction. However, while promising, these tools still lack comprehensive integration with backward design or other established pedagogical frameworks.

Together, these studies suggest that while hybrid models and co-design with AI are gaining traction, there remains a need for research-backed, theory-aligned, and educator-friendly frameworks. The model introduced in this paper directly addresses these challenges by offering a structured, replicable approach that places teachers at the center of the instructional design process. Rather than automating lesson planning, it positions AI as a thinking partner, helping educators align learning goals, assessments, and activities in a coherent, transfer-oriented manner.

Conceptual Framework: Effective Instructional Planning with Backward Design

Backward design, particularly as described by Wiggins and McTighe in *Understanding by Design (UbD)*, is an approach that organizes curriculum development by focusing on desired learning outcomes first, then working backward to develop the instructional methods and assessments necessary to achieve these outcomes (Wiggins & McTighe, 2005). The backward design model has three stages, each with a distinct function, and emphasizes alignment among learning objectives, assessments, and learning activities to ensure meaningful and transferable learning experiences for students.

Stage 1: Identify Desired Results: In the first stage, educators clarify what they want students to learn and retain long-term. These big ideas and essential questions serve as guiding principles that move beyond rote memorization and aim at fostering a deep understanding of transferable concepts and skills. This stage includes five learning goals, but for the scope of this work, we only focus on setting transfer goals, which encourage students to apply their knowledge and skills independently across varied contexts (Wiggins & McTighe, 2005). Transfer goals are pivotal in backward design, aiming to prepare students to use their learning effectively in real-life scenarios, whether in problem-solving, analysis, or practical application. For example, a history class may have a transfer goal such as understanding how historical events inform present-day decisions and promoting proactive citizenship through knowledge application in current issues (Wiggins & McTighe, 2011).

Stage 2: Determine Acceptable Evidence: Stage 2 focuses on assessment planning, where educators decide on evidence that demonstrates whether students have met the desired learning outcomes. In backward planning, assessments for transfer goals are designed to go beyond factual recall; they emphasize performance tasks that showcase students’ understanding and ability to transfer knowledge (Wiggins & McTighe, 2005). This requires tasks that mimic real-world challenges, often referred to as authentic assessments. For example, students might design an amusement park ride to demonstrate

an understanding of physics principles, thereby showing they can apply abstract knowledge in a concrete setting (Wiggins & McTighe, 2011). These assessments ensure that students are not only learning content but are also developing skills to use this content practically.

Stage 3: Plan Learning Experiences and Instruction: The final stage involves designing the instructional activities that will help students achieve the goals set in Stage 1 and demonstrate them through the evidence planned in Stage 2. These activities should be purposeful, providing students with a balanced approach to skill development through varied strategies, including practice, inquiry, and reflection for promoting transfer goals (Wiggins & McTighe, 2005). The learning experiences support the attainment of knowledge, skills, and understanding, which the assessments are structured to measure. In the context of this article, we are only concerned with transfer-based activities by which students apply their understanding to problematic real or simulated cases. This stage completes the backward design triangle by ensuring the learning tasks align directly with both the objectives and the assessments, fostering continuity and coherence within the learning experience (Wiggins & McTighe, 2005).

Alignment across all three stages is often represented as a triangle in UbD resources, symbolizing the interconnected nature of the three stages. In practice, alignment ensures that each stage supports and reinforces the others, creating a coherent framework where students can build toward meaningful understanding and transfer of learning (Carnegie Mellon University, 2023).

While a comprehensive theoretical analysis of the relationship between generative AI and backward design is beyond the scope of this paper, our application of ChatGPT within each phase of the UbD framework illustrates how generative AI can function as a co-designer that supports alignment between goals, assessments, and activities. In this model, ChatGPT is used not as a standalone planning tool, but as an iterative design partner that can respond to teacher input, generate instructional ideas, and adapt to revisions as educators clarify learning goals or refine performance tasks. This interaction supports the core logic of backward design by helping educators begin with clear outcomes and continuously align each instructional component to support student transfer. Our approach demonstrates how generative AI can be meaningfully embedded within a proven pedagogical framework without replacing teacher expertise or judgment.

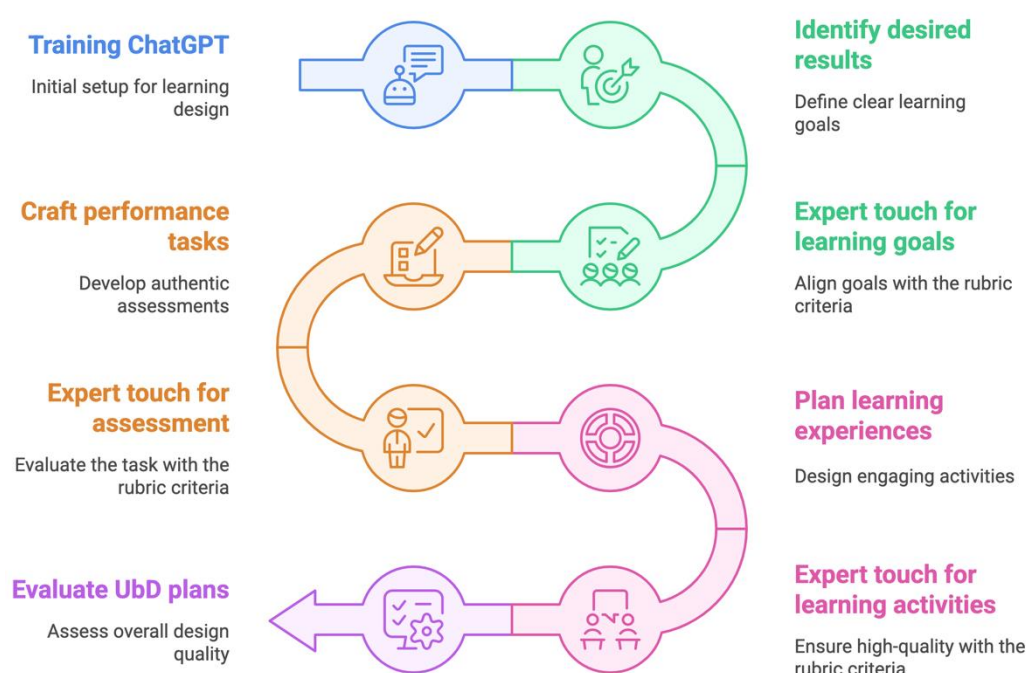
Methodology and Procedures

In this paper, we employed ChatGPT to generate initial drafts of instructional designs. These drafts were then meticulously reviewed and refined by our human educators. This iterative process ensured that the AI-generated content was pedagogically sound and aligned with our educational objectives. Although we did not collect traditional empirical data, our methodology embodies a systematic approach and procedures to integrating AI into instructional design, highlighting the collaborative dynamics between human expertise and artificial intelligence.

ChatGPT as a Co-design Partner: Using AI tools like ChatGPT in backward planning offers teachers a dynamic and efficient way to develop and align learning goals, assessments, and instructional activities. ChatGPT supports the backward design process by assisting with the three main stages and ensuring alignment among the objectives, assessments, and activities, enhancing the coherence and practicality of the instructional design.

To achieve effective instructional planning, we implement the mini three-step model¹ outlined previously, incorporating ChatGPT as a co-design partner in a hybrid design cycle, see the illustration of the process in Figure 1. This process begins with *training* ChatGPT, which includes uploading foundational documents, providing examples, and carefully crafting effective prompts. Then, effective prompting follows. Recognizing that crafting effective prompts can be a time-consuming task that presents challenges for educators, we employed research-based prompting techniques. These methods were specifically designed to generate ready-to-use text that aligns with instructional goals, ensuring the outputs can be seamlessly integrated into lesson plans and support effective teaching strategies.

Figure 1. ChatGPT as a co-design partner process



Training ChatGPT: It is essential to create outputs aligned with backward design principles. For Step 1 (Writing transfer goals), we utilized “Demystifying Transfer Goals” by McTighe (2021), a resource that provides theoretical insights and examples of transfer goals. This document helps ChatGPT understand the purpose of long-term learning objectives, which guide instructional planning focused on enduring understanding and application. In Step 2 (Crafting Performance Tasks), we leveraged McTighe’s blog post (2015) on designing authentic tasks. This resource serves as a guide for assessing students’ mastery of transfer goals through authentic, meaningful tasks. It helps ChatGPT generate performance assessments that align well with the overarching objectives, ensuring students can demonstrate understanding and transfer knowledge in real-world contexts. For Step 3 (Planning Authentic Learning Experiences), we found McTighe and Seif’s (2014) work on “Teaching for Understanding” valuable in training ChatGPT to support instructional activities that promote depth of understanding. This resource enriches ChatGPT’s response capabilities in designing scaffolded activities and inquiry-based tasks that connect directly to learning goals.

Techniques for effective prompting: As these resources provide a knowledge base and references to ChatGPT, effective prompting makes the output better tailored to our needs (Bozkurt, 2024). There are several prompting techniques and frameworks (e.g., Schulhoff et al., 2024). The prompts we used follow “the best practices for effective prompt design”(Fagbohun et al., 2024) and include clear instructions, relevant context, audiences, specific tasks, and step-by-step procedures. Asking follow-up questions, providing external files, and evaluating outcomes are also integrated into our hybrid co-design cycle. We used a research-based feedback rubric to evaluate the outputs developed by Gunes Savul et al. (2024) and Wiggins and McTighe (2011).

To evaluate the quality and alignment of UbD plans created using the co-design model, the UbD analytical rubric and a validated framework for assessing UbD unit plans were incorporated. This rubric consists of 29 items organized into four main categories: Desired Results (e.g., clarity of transfer goals and alignment with learning outcomes), Assessment Evidence (e.g., authenticity and evaluability of performance tasks), Learning Plan (e.g., scaffolding of instructional strategies), and Overall Coherence (e.g., alignment across all instructional components). The selected items were also presented in the appendix. Each item is rated on a scale from 1 (Needs major improvements) to 3 (Exemplary), allowing for a nuanced evaluation of instructional design quality. By using a comprehensive and structured rubric, we aimed to ensure that the generated plans not only demonstrated theoretical alignment but also pedagogical soundness and practical applicability.

This rubric was developed through an iterative design process and validated in previous research involving instructional experts and teacher educators. Inter-rater reliability was established using Fleiss' Kappa, with values ranging from 0.71 to 0.75 across categories, indicating substantial agreement among evaluators. In the study, trained raters independently assessed each UbD lesson plan using this framework, and discrepancies were resolved through consensus discussions. By incorporating a validated instrument and a systematic rating process, it was aimed to enhance the methodological rigor and transparency of the evaluation approach, offering a replicable model for future research on AI-assisted instructional planning.

To illustrate our hybrid co-design process, we present two cases: instructional planning based on 3rd-grade Next Generation Science Standards (NGSS) on Weather and Climate and an undergraduate biochemistry course at a public institution. We used publicly available documents and syllabi for the scope of the courses. By providing ChatGPT with these examples and guiding prompts, we modeled a responsive human-AI codesign process that produces outputs closely aligned with learning objectives, assessments, and activities—an essential aspect of backward design.

Prompts and Examples to Design Effective Instruction

The first prompt is to introduce yourself to your co-designer, shown in Table 1. Providing this foundational information allows ChatGPT to generate more relevant and targeted responses. Placeholders in all prompts with [ADD] can be replaced with contextual information. The links to the chat for each design process also include these details. Also, the whole chat history of both processes can be found as a DOI-linked supplementary materials.

Table 1. Introduction

Prompts #1
<p>I am an experienced [ADD YOUR ROLE]. I specialize in backward design and the Understanding by Design (UbD) curriculum model. I embrace a collaborative and dialogue-based approach to the design process, preferring to progress step by step. I also use a rubric to evaluate UbD plans.</p> <p>We will use this conversation to design assessments and activities centered around UbD principles, particularly focusing on Transfer and Performance Tasks. Here's some context:</p> <ul style="list-style-type: none"> • My students have [ADD INFORMATION ABOUT YOUR STUDENTS] • The primary goal of this course is [ADD YOUR COURSE GOAL] • I specifically want you to focus on [ADD A TASK] <p>Don't perform any tasks just yet—if you've read everything, simply reply with "Okay, I'm ready!"</p>

Step 1: Writing Transfer Goals

Defining clear and effective learning goals can be a complex task, but ChatGPT can simplify this process by assisting educators in identifying desired outcomes, including transfer goals, for their lessons and courses. The success of this approach, however, depends on how effectively the chatbot is guided. Below is a procedure for using ChatGPT to generate meaningful transfer goals, illustrated in Table 2:

1. Select a standard or a general objective from your area to be uncovered.
2. Provide the external resource(s) as a reference from backward planning.
3. Specify the task for ChatGPT.
4. Apply "expert touch" for refinement and evaluate the output using a set of criteria.

Table 2. Writing Transfer Goals

Prompts #2	
We will focus on these standards: [ADD YOUR STANDARDS]	
Using the information I provided about my lesson, we will write Transfer (T) goals. First, take a look at the article I uploaded: "Demystifying Transfer Goals" by McTighe (2021)	
You don't need to write anything about the article. Based on the information I shared with you and what you learned from the resource, write 4-5 Transfer goals that are suitable for my students.	
ChatGPT's Output for the 4th-grade Teacher	ChatGPT's Output for the University Instructor
<p>T1: Students will independently gather and analyze weather data, using tables and graphical displays, to make predictions about typical seasonal weather conditions in their local environment and other regions.</p> <p>T2: Students will apply their understanding of global climate differences to explain how local weather patterns can be affected by broader climate trends, comparing climates across different regions of the world.</p> <p>T3: Students will assess real-world design solutions aimed at mitigating the impacts of weather-related hazards (e.g., floods, hurricanes), making informed claims about their effectiveness and proposing improvements.</p> <p>T4: Students will use scientific investigation methods to monitor and evaluate weather conditions, utilizing the data collected to inform community decisions or personal actions that reduce the risks of weather-related hazards.</p>	<p>T1: Independently analyze and solve problems related to biochemistry in fields such as medicine, agriculture, and pharmaceuticals, demonstrating an understanding of its interdisciplinary applications.</p> <p>T2: Synthesize and communicate complex biochemical findings to diverse audiences, such as peers, professionals, or the general public, through both oral and written formats.</p> <p>T3: Independently locate, interpret, and evaluate current biochemical literature and data, integrating it into new or existing scientific questions and applications.</p> <p>T4: Design and propose solutions to ethical or practical challenges in biochemistry, considering global and societal implications.</p> <p>T5: Transfer understanding of biochemical processes, such as metabolic pathways and protein dynamics, to novel or unpredictable scientific scenarios.</p>

Expert Touch: Once ChatGPT generates the initial set of Transfer (T) goals, the expert applies their professional judgment to review the quality and correctness of the output. The expert will use both the design standards and a rubric to assess whether the goals meet the necessary criteria. To evaluate the output, the expert should ask the following key questions based on the design standards:

- Do the transfer goals encourage students to apply their learning to new, real-world situations, both in the present and future?
- Are the goals designed to push students to identify and solve genuine, real-world problems or situations where they can meaningfully apply their knowledge and skills?
- Do the goals require students to progressively demonstrate independence in applying their learning in new contexts, fostering autonomy over time?

By evaluating these aspects, the expert can refine the transfer goals to ensure they are robust and aligned with learning objectives, as shown in Table 3.

Theoretically, the output is expected to specify the desired long-term transfer goals that involve genuine accomplishment (Wiggins & McTighe, 2011). However, this doesn't always happen with LLM. Therefore, "human-in-the-loop" (Mosqueira-Rey et al., 2023) must be present. In other words, an *expert touch* in the form of a conscious intervention must control the design process and make quality control.

Table 3. Refinement in Transfer Goals

Prompts #3	
4th-grade Teacher	University Instructor
<p>I will select T1 and T4 from the generated transfer goals. These two goals align well with the desired outcomes of fostering autonomy and real-world problem-solving.</p> <p>However, before moving forward, here is some feedback for you on the goals for refinement:</p> <ul style="list-style-type: none"> • They could benefit from being more specific about the types of real-world problems or situations students will address. • Consider adding language that encourages students to take ownership of the learning process, guiding them toward independent use of skills and knowledge over time. 	<p>I like T1 and T2. However, these are comprehensive course goals, so we need to narrow them down to a single unit of study. Take only T1 and create me two Ts. Consider that one T for a two-hour session and the other is for another two-hour session.</p> <p>Here is my feedback to T1 for refinement:</p> <ul style="list-style-type: none"> • Real-world situations are emphasized but they are not specific. Give concrete examples in at least one of the disciplines in a problem format that fits the context. • Separate “analyze” and “solve problems” and focus on each independently.
ChatGPT’s Output for the 4th-grade Teacher	ChatGPT’s Output for the University Instructor
<p>T1 (Refined): Students will independently collect and analyze local and regional weather data over time, using tables and graphical displays to predict seasonal weather patterns.</p> <p>T4 (Refined): Students will use scientific investigation methods to track and evaluate weather conditions, applying their findings to propose actionable strategies for reducing risks associated with weather-related hazards (e.g., flooding, extreme temperatures) in their community.</p>	<p>Session 1: Transfer Goal (T1a) Analyze Biochemical Relevance in Medicine Students will independently analyze the biochemical implications of genetic mutations by interpreting case studies.</p> <p>Session 2: Transfer Goal (T1b) Solve Biochemical Problems in Agriculture Students will independently propose solutions to a real-world agricultural issue, such as increasing crop yield in nutrient-depleted soils.</p>

The output is now evaluated if it is worthwhile or not, using the UbD Rubric by Gunes Savul et al. (2024) and the design standards by Wiggins and McTighe (2011). Educators ask questions about (1) the application to novel situations, (2) the presence of a real-world problem or an issue, and (3) the independent work over a period of time.

Once evaluated, the transfer goal(s) can be used to design related assessments and directly used in the classroom settings in several ways. For example, teachers/instructors can post the transfer goal statements visibly in the classroom. At the beginning of lessons, they can explicitly connect the day’s activities to the goal, prompting students to reflect on how the knowledge and skills gained could be used in different contexts. Similarly, students can restate the transfer goals in their own words at the beginning of a unit and set personal learning targets. They can also be asked to bring the local happenings of their community related to the transfer goals. Throughout the unit, teachers can check in with them to ensure they are consciously working towards achieving the transfer goal. Teachers can also use these goals embedded in exit tickets or reflective journals to show how the transfer goal applies to their learning. For example, they can identify future situations in which they might use the skills and concepts from the unit. Once students meet the transfer goals, teachers can organize classroom celebrations or showcase sessions where students share how they’ve applied the knowledge or skills gained during the unit.

Step 2: Crafting a Performance Task

Designing performance tasks that align with transfer goals requires a focus on real-world application and problem-solving (Wiggins & McTighe, 2005). ChatGPT can be a valuable tool in brainstorming, structuring, and refining authentic, scenario-based assessments that target these skills. Using the G.R.A.S.P.S. framework (Goal, Role, Audience, Situation, Product/Performance, Standards) (McTighe & Wiggins, 2010), educators can create tasks that are contextually relevant and challenge students to

engage actively in problem-solving and application. The following procedure in Table 4 outlines how to use ChatGPT to design assessments that meaningfully reflect student understanding:

1. Brainstorm potential ideas for authenticity that are aligned with the transfer goal.
2. Apply “expert touch” and select a suitable option.
3. Create a scenario-based authentic task by using G.R.A.S.P.S.
4. Apply “expert touch” to review the problem and evaluate the output using a set of criteria.

Table 4. Potential Ideas for Performance Task

Prompts #4	
<p>Using the Transfer goals I have decided on, please write 4-5 Performance Task (PT) ideas related to my lesson. Each idea should be no longer than 2-4 sentences.</p> <ul style="list-style-type: none"> • The tasks should involve open-ended problems or contextual situations. • Make sure that the tasks are directly related to the unit topic and appropriate for the developmental stages of the students (e.g., they should be tasks that younger children can handle). 	
ChatGPT’s Output for the 4th-grade Teacher	ChatGPT’s Output for the University Instructor
<p>1. Students will collect weather data (e.g., temperature, precipitation) from their local area and a selected region over a 4-week period. They will use tables and graphs to compare the patterns and present their predictions about how the weather may change in the next month, explaining how seasonal shifts impact their predictions.</p> <p>2. Students will work in groups to research a recent weather-related hazard (e.g., a flood or heatwave) in a nearby community. They will evaluate how the community responded and propose additional strategies, using their understanding of weather patterns, to reduce future risks.</p> <p>3. Students will design a “weather preparation guide” for their families, using weather data they’ve collected. In the guide, they will include recommendations on how to prepare for seasonal changes or potential extreme weather events, using tables and graphs to justify their suggestions.</p> <p>4. In a simulated scenario, students will act as meteorologists tasked with predicting weather for a local outdoor event. They will analyze local and regional data, create a weather forecast, and make recommendations to event organizers on how to adjust plans based on the predicted weather conditions.</p>	<p>1. Given a case study of a patient with a suspected enzyme deficiency (e.g., Phenylketonuria), students will analyze the biochemical pathway affected, identify the disrupted step, and predict the physiological consequences. They will justify their analysis using diagrams and evidence from the case.</p> <p>2. Students will receive information about a genetic mutation that alters the structure of a key enzyme in glycolysis. They will construct a flowchart showing how this mutation impacts the pathway, leading to downstream effects on energy production.</p> <p>3. Provided with two different therapeutic approaches for treating a metabolic disorder (e.g., enzyme replacement therapy vs. dietary modifications), students will evaluate the biochemical rationale behind each method and recommend the most effective treatment, supported by evidence.</p> <p>4. Students will analyze the biochemical basis of a drug’s side effects by interpreting data about its interaction with metabolic enzymes. They will write a brief explanation of how the drug’s mechanism can lead to unintended consequences in metabolic pathways.</p> <p>5. Using a hypothetical case where a patient exhibits symptoms of a metabolic disorder, students will propose diagnostic tests to pinpoint the defective enzyme or pathway. They must explain the biochemical logic behind their chosen tests and predict possible results.</p>

Expert Touch: Once ChatGPT generates the initial set of performance task ideas, the expert applies their professional judgment to assess the quality and alignment of the ideas with the selected transfer goals. The expert will use a rubric and design standards to evaluate the authenticity and educational value of the tasks. To refine the tasks and ensure they meet high-quality standards, the expert should consider:

- Does the idea present a scenario that reflects a real-world context or an authentic simulation of a professional or everyday situation?
- Is the idea closely aligned with the specific transfer goals selected in Step 1?
- Can the idea encourage students to engage with both a clear process and a final product?

By addressing these open-ended questions, the expert can use ideas to generate the performance task(s) to ensure they are authentic, aligned with the transfer goals, and structured to foster both process and product-based learning. as shown in Table 5.

Table 5. Crafting a Performance Task

Prompts #5	
<p>I selected idea # [ADD THE IDEA NUMBER] You can combine both to create one performance task in a scenario format using the GRASPS framework. Remember this task must be aligned with my transfer goals, as well.</p> <p>Create a detailed task for each step (Goal, Role, Audience, etc.) that fits this idea. Use the resource I uploaded for you: McTighe's blog post (2015)</p> <p>Pay particular attention to the Situation step, as it must clearly define a problem or context in which students face a challenge or issue. Design this situation carefully to reflect a real-world challenge students might encounter.</p>	
ChatGPT's Output for the 4th-grade Teacher	ChatGPT's Output for the University Instructor
<p>Goal: Your task is to collect, analyze, and interpret weather data from both local and regional sources. Using this data, you will predict weather conditions and propose strategies to address weather-related hazards that may impact a local outdoor community event.</p>	<p>Goal: Your task is to analyze a case study of a patient exhibiting symptoms of an enzyme deficiency disorder. The goal is to identify the disrupted step in a biochemical pathway, predict the physiological effects, and propose a potential biochemical explanation.</p>
<p>Role: You are a junior meteorologist tasked with helping local event organizers plan for an upcoming community festival. Your job is to use weather data to create accurate forecasts and recommend actions that will ensure the safety and success of the event.</p>	<p>Role: You are a junior biochemistry researcher working in a medical diagnostic lab. Your job is to use your knowledge of metabolic pathways and enzyme functions to investigate the patient's condition.</p>
<p>Audience: Your audience includes the event organizers, local government officials, and community members who rely on your expertise to make informed decisions about event logistics and safety.</p>	<p>Audience: Your findings will be presented to a team of medical professionals, including doctors and biochemists, who rely on your analysis to make diagnostic and treatment decisions.</p>
<p>Situation: A local community festival is scheduled to take place outdoors in two weeks. However, recent reports suggest potential weather-related hazards, such as heavy rain or extreme heat, that could disrupt the event. Organizers need your help to forecast the weather conditions for the day of the festival and recommend strategies to mitigate any risks, such as rescheduling, adjusting event activities, or taking precautions to ensure public safety.</p>	<p>Situation: You have been provided with a medical report of a 35-year-old patient showing abnormal blood and urine metabolites. The patient suffers from fatigue, neurological symptoms, and elevated levels of phenylalanine in the blood. Your challenge is to determine whether these symptoms indicate a disruption in the phenylalanine hydroxylase enzyme or another step in the pathway, and explain how this relates to the observed physiological effects.</p>
<p>Product/Performance and Purpose: You will create a weather report that includes tables and graphical displays of weather data you have collected over the past two weeks. Additionally, you will present your findings and recommendations in a report or a short presentation, providing actionable strategies to address the potential weather hazards. Your final product should include a forecast, safety recommendations, and a rationale for your decisions based on the weather data.</p>	<p>Product/Performance: You will create a detailed diagnostic report that includes:</p> <ol style="list-style-type: none"> 1. An analysis of the biochemical pathway affected and the specific step disrupted. 2. A logical prediction of the physiological effects based on the disruption. 3. A clear explanation of your reasoning, supported by evidence from the case study.
<p>Standards & Criteria for Success: Your performance will be evaluated based on the following criteria:</p> <ul style="list-style-type: none"> - Accuracy and relevance of weather data analysis. - Clarity and organization of tables and graphs. - Effectiveness and feasibility of the proposed strategies to reduce weather-related risks. - The ability to explain and justify your forecast and recommendations using data. 	<p>Standards & Criteria for Success: Your performance will be evaluated based on:</p> <ol style="list-style-type: none"> 1. Accuracy and depth of the biochemical analysis. 2. Logical coherence and clarity in explaining physiological effects. 3. Use of evidence from the case study to support your conclusions. 4. Professional tone and organization of the report.

To ensure the performance task meets the desired expectations and is aligned with transfer goals, teachers/instructors should evaluate the generated task by reflecting on the following questions:

- Does the task provide multiple opportunities for students to demonstrate their understanding and skills throughout the process, rather than just at the end?
- Does the task assess whether students have achieved the transfer goals, specifically measuring their ability to apply learning in new contexts and solve real-world problems?
- Does the task allow students to personalize their approach, enabling them to play to their strengths and interests without compromising the assessment's validity?
- Does the task include different forms of evidence (e.g., written, verbal, or visual products) to ensure a comprehensive and reliable assessment of student performance?
- Are the evaluative criteria, such as rubrics or self-assessment tools, clearly aligned with the transfer goals and performance expectations outlined in Step 1?
- Is it clear to students what they need to accomplish in the task, and do the instructions cover all aspects of the expected performance?

These open-ended questions guide teachers in refining performance tasks to ensure they are comprehensive, aligned with educational goals, and capable of accurately assessing student understanding and transfer.

Once performance tasks are designed and evaluated, they can be integrated into the classroom in several impactful ways. Teachers/Instructors can begin by introducing the performance tasks early in the unit or semester, explicitly connecting them to the learning goals, and making the expectations clear to students. Performance tasks can be visibly posted in the classroom or the learning management system, providing a reference point that students can revisit throughout the unit. Students can engage with the performance tasks by interpreting them in their own words, either as part of class discussions or in individual goal-setting exercises. This process fosters ownership of their learning and helps them see the connection between classroom content and practical applications. Throughout the unit or the lesson, teachers can use these tasks as a tool for ongoing formative assessment. Regular check-ins allow students to demonstrate progress toward completing the task, while teachers can provide feedback on both the process and the final product. The performance tasks can also be embedded in reflective exercises, such as exit tickets or journals. Finally, once students have completed their performance tasks, teachers/instructors can organize showcases, science fairs, or celebration events where students present their solutions and explain how they applied their knowledge.

Step 3: Planning Authentic Learning Experiences

To support students in achieving transfer goals, instructional activities should focus on application, critical thinking, and real-world relevance (a challenge or a problem). As highlighted by Wiggins and McTighe (2005), effective transfer requires students to engage actively in learning that mimics authentic contexts, where they can independently apply knowledge beyond what they learned in structured lessons. ChatGPT can aid educators in generating such activities, fostering a scaffolded approach that supports increasing student independence. Below in Table 6 is a structured approach for using ChatGPT to design activities that nurture understanding and facilitate transfer:

1. Provide contextual information (student needs and profiles, your teaching style, the nature of inquiry you want to make, etc.).
2. Generate potential transfer-oriented activities.
3. Apply “expert touch” to select a suitable option or a sequence of activities and evaluate the output using a set of criteria.
4. Incorporate additional examples if needed,
 - a. Problem types (Ding et al., 2024) or
 - b. Learning that Transfers (LTT) (Stern et al., 2021).

Table 6. Authentic Learning Activities

Prompt #6	
Using the transfer goals, please create 5-6 activities that meet the following expectations and characteristics. Provide sufficient detail for each activity. My expectations for the activities:	
<ul style="list-style-type: none"> • Design inquiry-based and research-focused activities. • Include group work elements. • Ensure these activities are student-centered and hands-on. • [ADD YOUR EXPECTATIONS] 	
Read McTighe and Seif's (2014) "Teaching for Understanding and use your learning to create activities.	
ChatGPT's Output for the 4th-grade Teacher	ChatGPT's Output for the University Instructor
<p>1. Weather Data Research and Forecasting: Students will work in small groups to collect weather data from different regions (local and regional) using online tools such as weather websites or apps. Each group will be assigned a region and will track data (temperature, precipitation, wind speed) over two weeks. Students will analyze the data, create tables and graphs, and use them to predict the upcoming week's weather patterns.</p> <p>2. Designing a Community Safety Plan: After researching local weather hazards (e.g., floods, extreme heat), students will work in groups to design a community safety plan that mitigates the impacts of these hazards. Each group will identify potential risks, create solutions (such as evacuation routes or public service announcements), and present them to the class.</p> <p>3. Weather Event Simulation and Response: Students participate in a simulated weather emergency (e.g., a flash flood or hurricane). They will role-play as meteorologists, city planners, and emergency responders. Each group will create an action plan, including emergency preparedness steps, community response strategies, and methods to protect public safety.</p> <p>4. Investigating Global Climate Zones: Groups will research different global climate zones (e.g., tropical, desert, temperate) and analyze how the local climate impacts daily life, agriculture, and weather patterns. Each group will create an infographic or digital presentation summarizing the key climate characteristics of their assigned region.</p> <p>5. Weather-Related Hazard Investigation: Students will choose a weather-related hazard (e.g., hurricanes, droughts, or tornadoes) and research its causes, effects, and prevention strategies. In groups, they will compile their findings and create a visual representation (poster or digital display) to share with the class.</p>	<p>1. Students will investigate and map out a metabolic pathway disrupted by a genetic mutation.</p> <ul style="list-style-type: none"> - Students work in groups to research a given metabolic disorder (e.g., phenylketonuria). - They analyze the biochemical pathway, pinpoint the disrupted enzyme, and predict downstream effects. - Each group presents their findings visually through a pathway map and a brief explanation of physiological consequences. <p>2. Students will analyze case study data to diagnose a biochemical disorder.</p> <ul style="list-style-type: none"> - Groups are given patient profiles with biochemical data (e.g., blood metabolite levels). - Using online databases and research articles, they identify potential enzyme deficiencies. - Groups write a diagnostic report explaining their reasoning and recommend further tests or treatments. <p>3. Students will critically evaluate research studies related to a biochemical topic.</p> <ul style="list-style-type: none"> - Each group selects a recent scientific paper on enzyme function or a related topic. - Groups present the paper's findings to the class and lead a discussion about its implications. - They debate the study's reliability, citing evidence from the methods and results. <p>4. Students will propose a therapeutic approach to restore function in a defective enzyme.</p> <ul style="list-style-type: none"> - Groups brainstorm possible therapies (e.g., enzyme replacement, gene editing). - Using primary literature, they research the feasibility, risks, and benefits of their approach. - Each group creates a proposal poster and presents it during a mock "biomedical symposium." <p>5. Students will build a hands-on model to demonstrate a metabolic pathway.</p> <ul style="list-style-type: none"> - Groups use materials (e.g., colored balls, strings, and markers) to create a 3D model of a specific pathway. - They demonstrate how a specific mutation affects the pathway during a gallery walk. - Peers provide feedback and ask questions about the modeled disruption.

Expert Touch: To ensure the designed activities are well-aligned with transfer goals and promote meaningful student engagement, the teacher will evaluate the activities based on the following open-ended questions:

- Do the learning activities encourage students to reflect on their understanding and revise their work as the activities progress?
- Are students given opportunities to evaluate their progress through formative assessments and self-assessments?
- How does the activity extend over time, allowing students to apply their knowledge in varied, real-world scenarios?
- Is the structure of the activity designed to gradually reduce the teacher's guidance and increase student autonomy?

By addressing these questions, the expert ensures that the learning activities are thoughtfully designed to support student success, encourage deep thinking and revision, and promote the transfer of knowledge across different contexts.

Additional Examples: When educators want to explore alternative frameworks for designing transfer-oriented activities, two pedagogical models can also be used: Problem Types (Ding et al., 2024) and Learning that Transfers (TLL) (Stern et al., 2021). These frameworks provide different perspectives on transfer and can help refine or expand activity generation. Below is a short overview of each, along with sample prompts.

As shown in Table 7, Problem Types Framework (Ding et al., 2024) focuses on categorizing problems into types based on cognitive demand and reasoning processes. It emphasizes the need for students to engage in tasks that require them to identify patterns, apply conceptual understanding, and solve complex, real-world problems. Teachers can use this model to design varied types of problems that encourage deeper cognitive engagement.

Table 7. Problem-based Transfer-oriented Activities

Prompt # 7	
Using the Problem Types framework and my transfer goal(s), create three problem-based activities that encourage students to apply their conceptual understanding to real-world situations. Ensure that the problem types vary to challenge different cognitive processes, such as pattern recognition, reasoning, and problem-solving. You can use the information below:	
<p>Rule-Using Induction Problems (Well-Structured): These cases involve clear rules and guidelines that can be followed to arrive at a solution. They are straightforward and allow teachers to apply existing knowledge directly.</p> <p>Diagnosis-Solution Problems (Moderately-Structured): These cases require teachers to diagnose a problem and propose a solution. They are less clear-cut than well-structured problems and encourage deeper analysis and discussion.</p> <p>Dilemmas (Ill-Structured): These cases present complex situations with no clear solution, requiring teachers to navigate ambiguity and consider multiple perspectives. They foster critical thinking and the generation of new ideas.</p>	
ChatGPT's Output for the 4th-grade Teacher	ChatGPT's Output for the University Instructor
<p>Predicting Seasonal Weather Patterns (Rule-Using Induction Problem): Students will be given weather data tables from the past five years, showing temperature, precipitation, and wind speed for their region. Using established rules for interpreting weather patterns, students will predict the weather conditions for the upcoming season. They will apply their knowledge of weather cycles and patterns to forecast the next month's weather.</p> <p>Community Response to Extreme Heat (Diagnosis-Solution Problem): Students will be presented with a scenario where a local community is facing an extreme heatwave that threatens to disrupt daily life and local events. Their task is to diagnose the community's vulnerabilities (e.g., lack of shade, limited access to</p>	<p>Tracing Enzyme Deficiency in Phenylalanine Metabolism: Students are provided with detailed information about phenylalanine metabolism, including a pathway chart and normal metabolite concentrations. They receive lab data for a hypothetical patient with elevated phenylalanine levels. Using the provided rules (e.g., pathway diagrams and enzyme function charts), students identify the disrupted enzyme (phenylalanine hydroxylase) and explain the biochemical basis for the symptoms.</p> <p>Metabolic Acidosis in a Newborn: Students receive a case file for a newborn showing symptoms of metabolic acidosis, including blood pH, bicarbonate levels, and unusual organic acid levels. They must diagnose the disorder (e.g., Propionic</p>

cooling stations) and propose a solution. Each group will research how other communities handle heatwaves and present their action plan, considering both short-term and long-term solutions.

Postponing or Proceeding with a Festival (Dilemma): The students are event organizers who must decide whether to postpone or proceed with a planned community festival, as weather predictions suggest possible heavy rain on the event day. The dilemma requires students to consider multiple perspectives (economic, community enjoyment, safety), as well as the uncertainty of weather forecasts. They will debate the pros and cons of each option and make a decision based on incomplete information.

Acidemia) by analyzing the biochemical pathway and identifying the disrupted step.

Groups propose a solution, such as dietary modifications or enzyme replacement therapy, and justify their choice with evidence.

Ethical Implications of Gene Editing for Enzyme Deficiencies: Students are presented with a scenario where a biotechnology company proposes using CRISPR-Cas9 to edit genes in embryos to prevent enzyme deficiencies, such as phenylketonuria. Groups explore the scientific, ethical, and societal implications of the proposal.

They must consider multiple perspectives (e.g., scientific feasibility, ethical dilemmas, and potential unintended consequences) and present their stance in a debate or written policy recommendation.

In Table 8, Learning that Transfers Framework (Stern et al., 2021) centers on organizing learning around key concepts that encourage students to connect ideas across multiple disciplines and apply them to new, unfamiliar contexts. It uses the ACT mental model—Acquire, Connect, Transfer—as a way to scaffold learning, helping students transfer understanding to real-world situations.

Table 8. LTT-based Transfer-oriented Activities

Prompt #8

Using the Learning that Transfers framework and my transfer goal(s), create 2-3 activities that encourage students to connect key concepts across different disciplines. Ensure that each activity supports the ACT model by scaffolding learning through Acquisition, Connection, and Transfer of knowledge to real-world contexts. Design activities that require students to apply what they've learned to new and unfamiliar situations, promoting interdisciplinary thinking and meaningful application.

ChatGPT's Output for the 4th-grade Teacher

Climate Change and Community Impact: In groups, students will design a community outreach poster or digital presentation for the school on how local weather patterns might change over time due to climate change. They'll suggest actions the community can take to prepare for these changes, bridging science with social responsibility and environmental awareness.

Data-Driven Decisions: Preparing for Local Events: Given an upcoming local event, students will act as "weather advisors" for event planners, using their data analysis to decide the best date and time. They will present their recommendations in a formal report, applying mathematical and scientific reasoning to real-world planning.

Exploring Ecosystems and Weather Hazards: Students will create a survival guide for their ecosystem, addressing how both people and animals can use the natural landscape and resources to mitigate the impacts of weather hazards. This activity encourages interdisciplinary thinking, linking science, ecology, and safety in their local context.

ChatGPT's Output for the University Instructor

Biochemistry and Agriculture – Enhancing Crop Yield
Acquisition: Students learn about the role of nitrogen-fixing enzymes in soil health and plant growth, reviewing case studies on nitrogen fixation and soil biochemistry.
Connection: Groups compare enzyme-driven processes in human metabolism (e.g., the nitrogen cycle in biochemistry) to plant metabolic systems, identifying shared principles.

Transfer: Students propose innovative solutions for improving nitrogen uptake in crops, such as using enzyme-modifying bacteria or developing genetically engineered plants. They present their solutions in a proposal to an agricultural firm.

Biochemistry and Medicine – Personalized Medicine Design:
Acquisition: Students investigate how genetic mutations in enzymes affect metabolic pathways, reviewing examples from diseases like lactose intolerance or G6PD deficiency.
Connection: Groups discuss the interdisciplinary overlap between biochemistry, pharmacology, and genomics, exploring how knowledge of pathways informs drug design.
Transfer: Students design a personalized medicine approach for a hypothetical patient with a specific enzyme deficiency, considering genetic, biochemical, and pharmacological perspectives. Their work culminates in a mock medical panel presentation.

Putting All Steps Together

Connecting each step—Transfer Goals, Performance Tasks, and Learning Experiences—is essential for creating a cohesive and effective instructional design. This alignment, enhanced through an AI-human hybrid co-design approach, allows teachers to generate and refine instructional elements efficiently while ensuring that each component reinforces the others. AI can assist in creating examples, prompts, and assessments that resonate with students' learning needs, while the educator's expertise shapes these outputs to maintain relevance and instructional quality. Treating these steps as parts of an integrated whole—rather than isolated stages—enables a coherent and engaging learning experience. Through a continuous process of feedback, reflection, and AI-assisted revision, educators can establish a dynamic instructional environment where students are consistently encouraged to apply, reflect, and transfer their learning to real-world contexts.

Empirical Insights from Five Evaluation Studies

The co-design model described in this article is currently undergoing a series of ongoing research and evaluation efforts to refine its effectiveness and applicability. These evaluations are guided by practitioner-oriented strategies, as suggested by Bosworth et al. (1999), which emphasize the importance of systematically assessing the feasibility and success of new educational innovations. This approach ensures that insights gained from pilot implementations are grounded in practice and can inform broader applications. As Tate et al. (2023) note, pilot testing not only validates the reliability of the model but also provides valuable opportunities for iterative improvement based on stakeholder feedback. While preliminary findings offer encouraging evidence, the results must be interpreted with caution as further validation is required.

This co-design model has been piloted across diverse educational settings to evaluate its adaptability and effectiveness. To date, the model has been implemented with approximately 500 educators, including K-12 teachers, university faculty, instructional designers, and curriculum coordinators from private schools, as part of five research studies. Data collection for these studies has been completed, and the author(s) present preliminary findings below.

Study 1: In August 2024, in the first evaluation, a group of 29 teachers applied the model to create lesson plans using the hybrid co-design model. The end products (various lesson plans) were assessed using a detailed rubric (Gunes Savul et al., 2024) to evaluate the lesson plans comprehensively and to test the alignment of transfer goals, performance tasks, and learning activities. Preliminary results showed that 85% of the lesson plans met satisfactory ratings, indicating effective alignment with the theoretical frameworks underpinning the model. Similar findings were reported by Bai et al. (2024) showing that the enhanced AI chatbot and a human teacher scaffolding model improved instructional design performance. However, two teachers struggled with producing well-structured plans, which was attributed to deviations from the co-design process due to insufficient knowledge on the co-design model and lack of adding/uploading reference materials to ChatGPT. This finding supports previous research (Tan et al., 2025) suggesting that one of the biggest challenge of teachers was access to essential knowledge and technological resources (subscriptions, and materials).

Study 2: A pilot study with 15 English Language Arts teachers examined how the co-design model fits language instruction and the extent of teacher input needed to adapt ChatGPT outputs. Using an open-ended survey, teachers reported that while transfer goals were effective and rarely required revision, learning activities often needed additional prompts to include culturally relevant elements, such as songs or stories. This aligns with resources emphasizing the importance of human oversight to adapt AI outputs for diverse contexts (Mollick & Mollick, 2023). The findings indicate that stronger prompt engineering abilities lead to better performance from large language models, highlighting the importance of prompt engineering as a necessary skill for effectively using generative AI tools toward specific objectives (Knoth et al., 2024). Performance tasks were well-received, particularly by high school teachers, who found them detailed and appropriate for older students. However, some teachers identified the need to create custom rubrics for evaluating student performance. This finding is also parallel with some previous research suggesting that generative AI tools perform well at the lower levels of Bloom's taxonomy but there are weaknesses at the higher levels (Nguyen Thanh et al., 2023). These findings highlight the model's adaptability while emphasizing the importance of teacher input to tailor AI-generated materials for diverse classroom needs.

Study 3: In this study by the author of this study, 35 teachers from diverse subject areas practiced the hybrid co-design model in a bichronous professional development program aiming at enhancing their pedagogical knowledge (PK), pedagogical content knowledge (PCK), intelligent technological knowledge (i-TK), and intelligent technological pedagogical knowledge (i-TPK). These knowledge domains are critical for effectively using AI tools in effective instructional design. PK and PCK enable teachers to design lessons that are pedagogically sound and content-relevant (Mishra & Koehler, 2006), while i-TK equips them with the ability to navigate AI functionalities and tools (Celik, 2022). Furthermore, i-TPK supports teachers in understanding AI's pedagogical affordances, helping them interpret AI-generated outputs in meaningful ways (Celik, 2022). Preliminary findings indicate that teachers who demonstrated higher competency in these domains produced lesson plans with greater alignment between transfer goals, performance tasks, and learning activities. Notably, Karatas et al. (2024) as teachers gained more experience with AI, they are more willing to adapt their instruction accordingly. Similar results were also shown in numerous studies as reported by Dogan et al. (2025). In their in-depth systematic review, the researchers claimed that teachers demonstrating high competence in the mentioned domains produced more cohesive and aligned lesson plans. By fostering these competencies, the model has the potential to promote a balanced, reflective approach to AI-assisted instructional design, ensuring that AI complements rather than overshadows teacher expertise.

Study 4: In this study, a synchronous webinar attracted 450 educators, providing a large-scale platform to showcase the co-design model. During the session, the authors demonstrated examples and sample lesson plans, allowing participants to practice and refine their outputs in real-time. Immediate and corrective feedback was provided, fostering active engagement. According to an end-of-session survey, 90% of participants found the hybrid model straightforward to understand and appreciated the inclusion of pre-written, effective prompts. Parallel with this finding, a recent research by Park and Choo (2024) stated that educators' skill in prompt engineering is essential for interacting effectively with AI. The authors asserted that effective prompting boosts productivity and yields more accurate and relevant responses. Additionally, 75% of the respondents valued the "expert touch" questions, with one participant remarking, "It helped me infuse my expertise into my lesson," while another noted, "I am humanizing the outputs from ChatGPT as I add more feedback."

Further qualitative insights enriched the findings. Participants highlighted that iterative guidance helped them structure their lessons effectively. Many educators found the practice of training ChatGPT transformative, stating that it equipped them with prompt engineering skills crucial for tailoring AI outputs to specific educational needs. Similar findings were reported by Kosmas et al. (2025) suggesting that the co-design approach empowered educators, nurtured a sense of ownership, encouraged the exchange of ideas, and enhanced collaboration and motivation. A significant portion appreciated the ability to integrate culturally relevant activities, such as adapting tasks with regional or subject-specific nuances. Teachers reported that designing performance tasks, previously considered daunting, became manageable through the structured process. One participant remarked, "The detailed feedback loops clarified how to align AI-generated content with educational goals, ensuring relevance." Additionally, educators identified key learnings, including the importance of precise prompt design, the value of step-by-step instructions, and the use of visual tools like matrices for organizing tasks. These findings may underscore the model's adaptability and scalability while pointing to areas for further improvement, such as deeper support for first-time users and the development of advanced rubrics to evaluate AI-enhanced lesson plans. The webinar showcased how the co-design model can be effectively disseminated at scale, highlighting its potential for broader adoption in diverse educational contexts.

Study 5: Following the large-scale webinar described in Study 4, participants were tasked with completing a mini-project over one week, requiring them to develop a lesson plan and implement it within their own educational settings. A total of 148 responses were collected, providing a robust dataset for analysis. Preliminary text and document analysis revealed that most participants adhered to the same prewritten prompts provided during the webinar. However, 27 participants introduced additional prompts to further customize their outputs, demonstrating the adaptability of the co-design model.

In response to the question, "How did the co-design process with ChatGPT contribute to developing assessment and learning activities for your class?", several key themes emerged from participant reflections. Many educators appreciated the efficiency and structure provided by ChatGPT, noting that it facilitated clear alignment between learning outcomes and activities. For example, participants reported that the tool helped streamline the process of creating performance tasks, with one teacher

explaining, "It allowed me to quickly develop structured rubrics that align with my lesson objectives, something that would have taken hours otherwise." Additionally, educators appreciated how the co-design process facilitated culturally relevant lesson enhancements, with one participant highlighting, "ChatGPT helped me incorporate real-life examples and stories to make abstract concepts more relatable and engaging for my students." As also mentioned in Payadnya et al. (2025), effectively implementing AI tools requires adapting them to reflect students' cultural contexts, such as their language preferences and customary learning methods. These examples demonstrate the model's ability to support both efficiency and creativity in lesson planning.

Another recurring theme was the role of ChatGPT in enabling iterative design processes. Participants found the feedback loops particularly valuable. For example, one participant noted, "Providing feedback to ChatGPT allowed me to refine and humanize the outputs, making them more tailored to my students' needs." Another participant emphasized the time-saving aspect of the process, stating, "Using ChatGPT for initial lesson drafts gave me more time to focus on customizing activities for my students, especially when aligning them with diverse learning goals and outcomes," which is consistent with prior literature on AI as a creative partner with a cycle of follow-ups in instructional planning (Lyu et al., 2025).

When asked about the most effective aspects of human-AI collaboration ("What were the most effective areas of collaboration between human and AI in the co-design process?"), participants overwhelmingly identified content development and idea generation. ChatGPT was praised for generating creative teaching ideas, providing templates for activities, and supporting innovative approaches to lesson planning. For example, one participant noted, "ChatGPT offered new perspectives that I hadn't considered before, making my lessons more engaging and diverse." The results are not surprising since the collaboration between a chatbot and human includes a diverse set of productivity and instruction-related tasks and efforts as referenced in Bozkurt et al. (2023), Hashem et al. (2024)

While the overall feedback was positive, some educators reported challenges with adapting ChatGPT's outputs to specific contexts, such as incorporating complex assessment rubrics or tailoring materials for younger learners. These insights underline the importance of further training and support for educators to maximize the potential of the co-design model. As a result, this study highlighted both the strengths and areas for improvement in applying ChatGPT for instructional planning, particularly in balancing efficiency with the need for customization.

Insights from the Ongoing Pilot Studies: The series of studies conducted on the co-design model reveal its significant potential to transform instructional planning while highlighting key lessons and areas for refinement, as mentioned in how conversation with AI should be in Bozkurt (2023). Across diverse contexts and educator groups, the model consistently demonstrated its adaptability, scalability, and ability to foster meaningful human-AI collaboration. A recurring insight was the importance of structured frameworks—such as prewritten prompts, rubric evaluations, and detailed training sessions—in enabling educators to align AI outputs with pedagogical goals. Teachers across all studies reported that the co-design process not only streamlined lesson planning but also enhanced their ability to integrate creative and culturally relevant content into their teaching practices.

The feedback loops and iterative refinement processes embedded in the model proved particularly effective in empowering teachers to personalize and improve AI-generated content, striking a balance between efficiency and customization. The studies also underscored the role of prompt engineering and foundational AI training in equipping educators with the skills to fully leverage ChatGPT's capabilities. However, challenges were noted, such as first-time users' need for additional support and the occasional difficulty in tailoring outputs for specific educational contexts.

Application in K-12 and Higher Education Settings

This AI-assisted backward planning model is flexible enough to be applied across both K-12 and university settings. Given that backward planning has been widely utilized in K-12 schools (Gunes Savul et al., 2024; Celikman Hanratty & Eveyik-Aydin, 2023) and higher education (Tshering, 2022) to structure objectives, assessments, and instructional activities, the model's foundation is already well-suited to university faculty and can be adapted by K-12 teachers as well. Faculty members and teachers in any modality—face-to-face, hybrid, or fully online—can apply this process effectively. However, for online courses, more specific details may need to be incorporated into prompts to ensure that the

activities and assessments align closely with virtual environments. This approach allows educators to tailor learning experiences that support both structured in-class interactions and independent online engagement, leveraging AI as a supportive instructional partner.

This AI-assisted instructional co-design model is both cost-effective and efficient. With only six key prompts and three document uploads to ChatGPT, educators can generate structured, aligned content to support their lessons. Even with two additional prompts for specific activities, this process remains manageable within the limitations of ChatGPT's free version, making it accessible to educators without the need for premium resources. By minimizing the time and financial costs typically associated with instructional planning, this model empowers teachers and faculty to focus more on student engagement and meaningful interaction.

Ensuring Ethical and Responsible Use of the Hybrid Co-Design Process

The use of ChatGPT in this co-design model is grounded in ethical and responsible practices to ensure that its integration supports educators effectively while addressing potential concerns. By adhering to a framework that emphasizes transparency, accountability, and collaboration, this approach aligns with ethical principles highlighted in recent literature. For instance, ChatGPT serves as a co-design partner, not a replacement for human expertise, allowing educators to retain control over instructional decisions and ensure the alignment of AI-generated outputs with pedagogical objectives (Su & Yang, 2023). Additionally, the model incorporates reflective practices and feedback loops to continuously evaluate the role of ChatGPT in lesson planning, addressing concerns related to over-reliance on AI and ensuring its outputs support personalized and effective teaching (van den Berg & du Plessis, 2023). By integrating AI tools like ChatGPT with a clear ethical framework, this co-design model empowers educators to enhance their teaching practices responsibly, providing a pathway for professional growth and meaningful student engagement (Shamsudin & Aris, 2023; McGuire, 2023).

Limitations and Considerations for Its Effective Use

Despite its adaptability, this co-design process is not without limitations. Educators who are new to AI or instructional planning may face initial challenges due to the foundational knowledge required for effective implementation. This includes a basic understanding of AI, referred to as i-TK and i-TPK (Celik, 2022), which encompasses knowledge such as navigating a chatbot, prompt functionality, evaluating AI outputs, and applying pedagogical skills effectively for instruction. Additionally, educators need to be proficient in basic instructional planning, including defining objectives and conceptualizing how assessments align with these goals. Without these foundational skills, implementing the model may require additional training or support to be fully effective.

Other key limitation of this model is that the co-design process may be unfamiliar to some educators, particularly those accustomed to more traditional, top-down approaches to curriculum development. As noted by Penuel et al. (2007), co-design requires active collaboration, iterative feedback, and shared ownership of the design process, which can be challenging for individuals new to this method, even harder when it is with an AI-based tool. Educators may need additional support and professional development to navigate the collaborative and reflective nature of human-AI hybrid co-design effectively. Without such preparation, participants may struggle to fully engage in iterative refinement or to balance their roles as both contributors and learners within the process.

This model focuses on a co-design process rather than the direct implementation of lesson plans, requiring caution and thoughtful application. One key recommendation for effective use during teaching is incorporating ongoing reflection and feedback as integral components. Reflection allows educators and co-designers to evaluate the effectiveness of their designs iteratively, ensuring alignment with learning goals and responsiveness to classroom dynamics (Penuel et al., 2007). Collaborative feedback loops further enhance the implementation process by fostering professional growth and creating a culture of continuous improvement among teachers/instructors (Daniel et al., 2013). For instance, incorporating reflection logs and peer feedback sessions throughout a teaching period (i.e., prolonged time) can help refine lesson plans and instructional materials, addressing any gaps or challenges.

Future Directions: Research and Used Cases

Future research could expand on these findings by investigating the model's effectiveness across diverse content areas, exploring its impact on various student demographics, and examining longitudinal effects on instructional quality and educator confidence. Comparative studies between AI-human co-design and traditional planning methods could offer critical insights into how AI can enhance instructional design processes, particularly in terms of efficiency, alignment, and engagement. Moreover, future studies should explore the nuances of using the model in under-resourced educational contexts, assessing its potential to address equity gaps by providing scalable, high-quality instructional support.

To further its application, future iterations of the model could focus on integrating domain-specific AI tools, offering enhanced capabilities for content customization and interactive learning design. Additionally, longitudinal case studies could track how educators' confidence and skill levels evolve as they continue to engage with the model. By emphasizing ongoing support and training, future use cases could explore how the model scales across different institutional settings, from large universities to small, resource-constrained schools. This forward-looking approach will enable researchers and practitioners to refine the model's implementation, ensuring it remains responsive to evolving educational challenges and opportunities.

Conclusion

Incorporating ChatGPT and similar generative AI-based tools into instructional design offers promising potential to streamline processes, enhance engagement, and foster a more adaptive learning environment (Hodges & Kirschner, 2024). By adopting a backward design approach, educators can ensure that AI's efficiency aligns with pedagogical rigor, supporting a cohesive framework where transfer goals, performance tasks, and learning activities converge to create meaningful, real-world learning experiences. The three-step mini model demonstrates that with thoughtful training and prompting techniques, AI can serve as a co-design partner, assisting teachers in generating aligned, ready-to-use materials that save time while enhancing instructional quality. However, the effectiveness of AI in education hinges on responsible implementation. As noted in recent research from various fields such as business and medical, AI tools should complement, not replace, human judgment and expertise in instructional design (Indran et al., 2023; Ritala et al., 2023). This calls for a balanced, hybrid approach where educators retain an active role in evaluating and refining AI outputs to maintain relevance, personalization, and responsiveness to student needs (Cukurova, 2024).

Recent scholarly efforts have highlighted the potential risks of over-relying on AI, which may lead to a reduction in personalized interactions and a less nuanced approach to learning objectives, the integration of AI in instructional planning should prioritize the alignment of AI's strengths—such as rapid content generation and resource creation—with the unique insights and adaptability of educators. By fostering a dynamic, human-AI collaborative model, educators can navigate the evolving educational landscape with tools that promote deeper understanding and engagement. This hybrid approach maximizes AI's potential and respects the irreplaceable human elements of empathy, creativity, and critical judgment in the teaching process.

Focusing on the interrelated codesign process will much more likely enhance student learning. Through human oversight and instructor expertise, chatbots with LLM enable instructors to spend less time on design and much more time on student interaction (Mollick & Mollick, 2023) and personalized and effective feedback.

Notes: ¹ We renamed the process to avoid confusion since we use a mini version of UbD, the backward planning approach.

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Author's Contributions (CRediT)

Selçuk Dogan: Conceptualization, methodology, writing—original draft preparation, writing—review and editing. The author has read and agreed to the published version of the manuscript.

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