


**Case Study****Is AI the new course creator**Sheri Conklin<sup>1</sup>  · Tom Dorgan<sup>1</sup> · Daisyane Barreto<sup>1</sup>

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© The Author(s) 2024 **Abstract**

We investigated the utility of ChatGPT 3.5 in the creation of a fully online asynchronous higher education course. Our collaborative effort with ChatGPT resulted in developing a Master's level course on Trends and Issues in Instructional Design using the Backward Design Model. Throughout this process, we recognized the critical role of precise prompts and the need for continuous refinement to achieve the best possible outcomes. We delineated a workflow for effective prompts, underscoring the importance of setting clear objectives, employing a systematic sequence of prompts, and integrating feedback loops. Our research also emphasizes best practices and highlights the value of human expertise in collaboration with AI and the significance of validating AI-generated output. Through this process, we were able to develop a 14-week, three-credit course in a significantly reduced amount of time including generating HTML and CSS code for the Learning Management System. Although ChatGPT proves to be a powerful tool with the potential to expedite online course design and development significantly, it is crucial to acknowledge that human expertise remains indispensable for achieving optimal results.

**Keywords** Artificial intelligence · Course design · ChatGPT · Online learning · Prompt engineering**1 Introduction**

With the rapid changes and advancements in technology, it can be difficult for educators and researchers to keep up with the new trends in the field. A prominent technology of the moment is Artificial Intelligence (AI). Its rapid adoption can be seen in many fields, such as business, health, medicine, transportation, logistics, and education [37]. Even though AI is becoming more broadly adopted across fields, defining AI can be complex. There are two main reasons for this issue: (1) what AI constitutes may change and consequently be categorized as a computer program or an application, and (2) its interdisciplinary nature, which leads to multiple perspectives and terminologies [28]. Nonetheless, AI can be defined as machines designed to perform tasks that usually involve human intelligence [28, 47].

The integration of artificial intelligence (AI) into education is becoming increasingly prominent, with applications spanning multiple dimensions including development, extraction, and application. In the development dimension, AI is used to create sophisticated intelligent tutoring systems and assessment tools. The extraction dimension involves leveraging AI to provide feedback, support reasoning processes, and enable adaptive learning experiences. In the application dimension, AI facilitates affective computing, role-playing scenarios, immersive learning environments, and gamification in the educational context. Advanced AI technologies such as complex algorithms, visualization techniques, virtual and augmented reality, wearable devices, and neuroscience-based approaches are being incorporated to establish smart learning environments. Although AI demonstrates significant potential in personalizing

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learning experiences and enhancing teaching effectiveness, several challenges persist. These include ensuring appropriate implementation, addressing the evolving roles of educators and students, and navigating ethical considerations surrounding data utilization in educational settings [53].

In November 2022, U.S. company Open AI released ChatGPT, an artificial intelligence (AI) program that draws upon a large database to generate responses from text-based inputs by humans. The emergence of AI has disrupted many organizations, such as higher education. These AI tools are designed to interact with users in a conversational manner, providing responses that mimic human dialogue and can support educational activities ranging from task motivation and personalized learning to assessment and content generation [20].

With minimal training data, ChatGPT has become a powerful tool with 175 billion parameters compared to the 110 million parameters of the BERT model proposed by Google in 2018 [22]. Because of its broader capabilities, educators have begun to use these Large Language Models (LLMs), such as ChatGPT, in various ways: tutoring and homework help, content creation, and generating learning resources (Open AI, 2023). Conversely, there are concerns among faculty regarding the use of AI surrounding integrity and ethical implications, where its use could lead to issues such as plagiarism, suppression of critical thinking, and erosion of originality [17].

While faculty perceptions of AI integration vary, early adopters expressed mixed feelings in a social media content analysis study, with concerns about productivity, efficiency, and ethics [35]. Many are concerned about academic honor code violations and lack of clear policies and detection methods [3, 27, 41, 44]. While some anticipate AI-assisted coursework completion increase, others oppose restrictions to its use in coursework [41]. Despite its familiarity, faculty remain uncertain about effective AI integration and lack trust in its use [41]. While these are ongoing concerns, this paper focuses on determining how AI can assist faculty in the course design process efficiently and effectively.

As educators explore the integration of LLMs, especially in course content creation, it is important to examine the course design and development process. Designing and developing an online asynchronous course involves several stages: planning, course design, content development, evaluation, and revision. Typically, faculty work with instructional designers to design and develop asynchronous courses. This collaboration assists with course design elements and learning various technologies, including the Learning Management System (LMS) in which the course will be located. Developing a 15-week fully online course typically requires a significant amount of time and effort. According to research by Allen and Seaman [2], creating a single online course can take anywhere from 6 to 9 months. Additionally, Kim and Bonk [21] found that the process typically involves investing around 114 h. DeFelice [8] investigated the development time for various instructional products and discovered that it could potentially require an average of 55 h for each 25-min module. This equates to over 700 h of development time for a full-term course.

AI language models, like ChatGPT, possess various competencies, including providing responses in a conversational manner, generating content based on a given prompt, and creating HTML code. It can also assist faculty with course design and development, which may reduce instructors' time designing and developing fully online and hybrid courses while simultaneously creating robust and rigorous courses [10]. In this case study, we seek to explain the process and determine the efficacy of ChatGPT in designing and developing a master-level asynchronous course on Trends and Issues in Instructional Design (TIID). Specifically, the questions that we seek to address with this case study are:

1. To what extent will a collaboration with ChatGPT assist in reducing the amount of time to design and develop a new course?
2. What is the process involved in course design and development with ChatGPT collaboration?

The process identified as a result of this study is versatile and can be applied to any discipline at the graduate and undergraduate levels. Additionally, we found that it significantly reduced the amount of time needed to design and develop a fully online asynchronous course (Table 1) compared to aforementioned research of over 120 h.

Although the design approach for the TIID course mirrors traditional content development processes, we have specifically aligned it with the Backward Design model to ensure all course elements proposed are meaningful and purposeful. The Backward Design model plays a pivotal role in course design by inverting the traditional planning process. Instead of starting with the syllabus and moving toward assessments, this model begins with the end in mind, focusing on desired learning outcomes and then working backward to determine the instructional methods and materials needed to achieve those outcomes [16].

**Table 1** Overview of the amount of time spent on the course design process

Design and development	Hours spent on task (estimated)
Course goals, description, and module objectives	5
Instructional materials	16
Assessment and activities	10
Course development	10

## 2 Literature review

The increasing prevalence and accessibility of ChatGPT have prompted researchers and educators to evaluate its potential, challenges, and limitations in the field of education [10, 32, 34, 49]. Furthermore, they have examined the implications of ChatGPT for course design and development [10, 32, 34]. Tupper et al. [45] found that ChatGPT effectively performs tasks such as selecting learning objectives, instructional activities, and assessments. However, it is crucial to recognize the importance of the human element for optimal results, including prompt optimization and content revision [23, 45]. Maynard [32] leveraged ChatGPT's capabilities to develop a course focused on artificial intelligence. The researcher collaborated with ChatGPT to devise various exercises and assessments to help students refine their ability to construct prompts. Through this experience, Maynard [32] emphasized the significance of fact-checking, as ChatGPT was found to provide incorrect information occasionally. Another instance where the potential of AI was explored was by Meron and Araci [34], who utilized ChatGPT to design a postgraduate studio course. The authors discovered that while ChatGPT could efficiently develop outlines and facilitate brainstorming sessions, it required detailed prompts at times, even multiple prompts, to attain the desired results. Furthermore, it was crucial to have a Subject Matter Expert (SME) to refine the output generated by ChatGPT [34, 46]. This refinement is necessary because AI-generative tools like ChatGPT and other similar tools can produce unreliable and inaccurate results [25].

Furthermore, Alasadi and Baiz [1] warned educators about the potential risks associated with utilizing generative AI, which could lead to instances of plagiarism and ultimately undermine the value of work produced by humans. Nevertheless, the implementation of AI in academic settings presents numerous challenges, including guaranteeing the veracity of information, assessing the dependability of sources, and grappling with the issue of plagiarism [3, 19, 24].

The next sections of this literature review will address a common framework for course design as well as the prompt engineering process when using generative AI.

### 2.1 Course design framework

Several factors can influence the design and development of an online course. One of the most significant factors is the instructor's experience level and familiarity with online course design and development. Instructors with prior experience complete the course design quicker than those new to online course development [2]. Although many frameworks can be employed to optimize the design and development of an online course, a popular framework adopted by the instructional designers, and also implemented for this course design project, is the backward design. Backward design, is a three-stage process used to design and develop curriculum, courses, lessons, and other instructional events [50]:

1. The first stage of this process involves identifying the learning outcomes (e.g., what will learners be able to do or accomplish as a result of the instruction?).
2. Next, it includes determining the assessment(s) in which learners can demonstrate the learning gained.
3. Finally, the third stage addresses the planning of instruction and learning experience, which includes the instructional materials and activities in the lesson plan [51].

This process can be adopted for course design and development and for planning small course units, such as lessons and other instructional events [52]. This process has been selected because of its curricular planning nature, student-centered focus, and easy course design structure. Initially, Backward Design principles have been used to create the course with ChatGPT collaboration. Although three stages are identified in this process, it is not linear but iterative, employing a cyclical process of revisions and improvements to the other stages. Using Backwards Design also ensures alignment among the course materials.

## 2.2 Prompt engineering for course design

LLMs, such as ChatGPT, rely on prompts, essentially a set of instructions to generate content [25]. Prompt engineering is a process of refining and editing prompts [48] to guide the LLMs through the prompts. Prompts offer the potential for self-adjustment, suggestions, and the ability to collect additional information or generate related content. These advanced capabilities of prompts emphasize their significance in engineering beyond simple text or code generation [49]. Prompt patterns are specific task-oriented instructions that guide LLM responses. They consist of core contextual statements that enhance the precision and relevance of LLM-generated outputs. There are many techniques for effective prompt engineering. First, the instructions need to be clear and specific. Additionally, constraints such as format, length, and scope within the prompt can be used to generate the desired outcome [12]. For example, asking ChatGPT to produce an output in three sentences or using a framework such as Bloom's taxonomy. Effective prompt engineering is essential for achieving these models' desired and useful results [12, 49].

Improving prompt engineering is an iterative process of testing and refining [12]. By documenting and leveraging prompt patterns in the context of automating software development tasks, users can ensure that relevant information is included and change the format of interaction with the LLM to achieve the desired output [49]. There are a variety of prompt patterns. For this project, we focused on three patterns: persona prompt, audience persona, and fact checklist (see Table 2).

Persona prompt pattern tells the LLM to act as a certain persona and generate text from the perspective of a defined individual. This pattern allows the model to generate text as if it were the specified person in the prompt, aligning the output with the perspective, language styles, motivations, experiences, and expertise associated with that individual [4]. This will ensure the content will speak directly to your audience [48]. Once the persona has been identified, the users can describe what they want the LLM to produce (e.g., create goals for a course on X) [49].

The audience pattern tailors the prompt to simulate addressing a particular audience. By specifying an intended audience, the generated text can match the style and complexity appropriate for that audience [48]. In the example in Table 2, the model generates text suitable for a high school student, utilizing simple language and avoiding overly technical terms [7]. Additionally, going beyond identifying the audience will assist ChatGPT with the response. For example, including the audience's needs, addressing specific concerns, or providing relevant examples can help ChatGPT respond appropriately [4].

Finally, the fact checklist pattern structures the prompt to elicit a specific type of response, often in the form of a list or a set of facts. It guides the model to generate organized and factual information. The model is directed to provide a list of advantages and disadvantages, promoting a structured response [7].

Some best practice for creating prompts is to be clear and specific, which leads to more accurate and relevant outputs. Providing a structured format or requesting a list can lead to more organized and informative responses. By documenting prompts, the user can iteratively test and refine prompts, which is crucial to understanding how the model responds and how to improve the quality of the generated content [48]. Understanding and utilizing different prompt patterns can significantly influence the outputs of LLMs, making them more targeted, accurate, and suitable for various purposes and audiences [4, 48, 49] (see Fig. 1).

## 3 Development setting

The course developers (and authors) included two faculty members in an instructional technology program and an LMS administrator with an instructional technology background. All parties served as SMEs throughout the process. The faculty members and the LMS administrator were also unfamiliar with ChatGPT.

We aimed to design and develop a new course for the Instructional Technology program while simultaneously testing the hypothesis that ChatGPT could reduce the course design and development process time while noting the challenges and added value of collaborating with ChatGPT. Although a section instructor for the course had yet to be assigned, it was assumed one of the developers would teach the course. ChatGPT was integrated upon course conception to develop the entire course, including the course goals and description. Further, we worked with ChatGPT to devise educational course components such as learning objectives, lecture materials, and exercises, all of which were presented in text form.

**Table 2** Prompt patterns, definitions, and examples

Prompt pattern	Definition	Example
Persona	The user prompts the LLM to take a persona (e.g., act as a person, role, job title, etc.) and generate text based on the perspective of the persona taken	Acting as a professor for a graduate level Instructional Technology program, develop an assignment for an entry-level course on trends and issues in the field
Audience	The user prompts the LLM to respond or address an audience in their request	Explain the uses of AI to an 11th-grade AP Biology class
Fact checklist	The user prompts the LLM to respond in the form of a list or a set of facts	List the advantages and disadvantages of adapted learning

## Crafting a Prompt: It's all about asking the right question.

The key to this process is iterative refinement. It might take several tries to get the desired result, but each iteration brings you closer to a high-quality response.

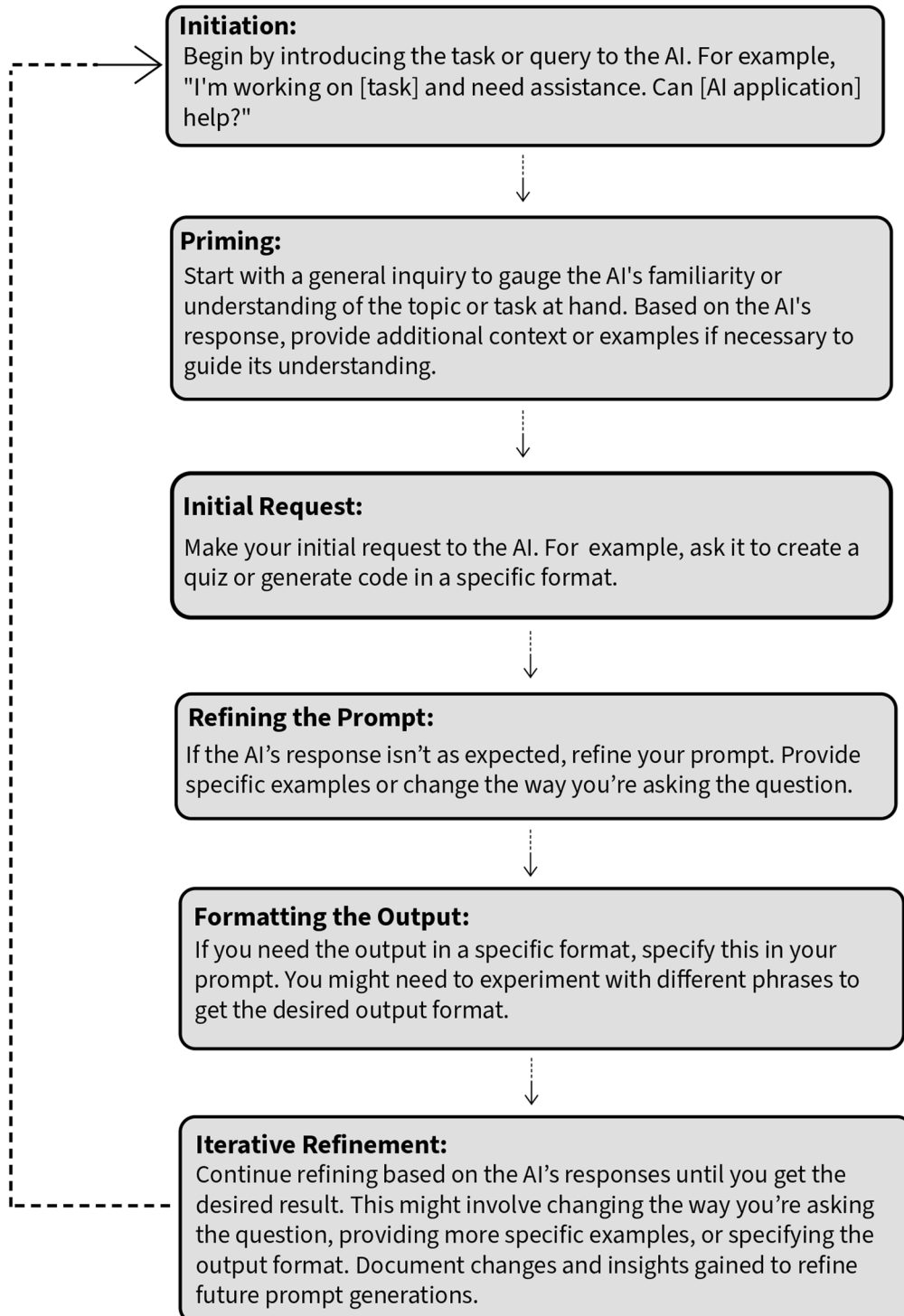


Fig. 1 Prompt engineering flowchart for the course design process

A self-study methodology was utilized [14], and the subjectivity of this approach was acknowledged. It may contain limitations resulting from our personal and professional affinities, particularly with the prompts used with ChatGPT. The next section explains how the prompts changed to produce targeted output and create an online course.

## 4 Methods

### 4.1 Study context

As a basis for this study, we utilized theory adaptation as a research design for this conceptual paper [31]. The Backward Design Model was selected because of its focus on curricular planning and aims to build and improve student understanding [11], which are important aspects of the course design process. The extant knowledge of the model was revised by introducing alternative frames of reference to propose a novel perspective [29] of its application, given the introduction of new tools in assisting the course design process (see Fig. 2). The collaborative development of the course with ChatGPT 3.5 resulted in a new online asynchronous graduate-level elective titled Trends and Issues in Instructional Design (TIID). The course designers for this project are trained instructional designers who have designed and taught multiple courses for 15 years. They are also well-versed with the LMS (i.e., Canvas) used by their institution to deliver course content. During the project, the collaborators held weekly meetings spanning over 2 months to review ChatGPT-generated content and revise prompts to ensure fine-tuning of the output from ChatGPT. ChatGPT contributed to the project by generating course goals, module objectives, instructor lecture content, assessments, and rubrics.

In the design and development of the course, all prompts and output were recorded and used to develop the next prompt in an iterative process. This next section will outline our process to design and develop the TIID course based on the Backward Design Model, including prompt patterns, time spent on the task, and the outcome.

### 4.2 Course design process with ChatGPT collaboration

In following this process, course designers initially prompted ChatGPT to identify the learning outcomes for the course. Next, the course designers requested ChatGPT to identify the assessments for the course based on the learning outcomes generated by ChatGPT. In the final stage, which involved ChatGPT generating the instructional materials and activities for the course, the course designers identified an issue. When the course designers prompted ChatGPT to generate instructional materials for the course based on the learning outcomes, these materials showed weak connections, which needed to have overall alignment with the assessments. This limitation could have been caused by: (a) course designers not using the same initial thread of prompting since they operated these tasks from different computers at different times, and (b) ChatGPT current memory limitation. According to Khan and Singh [18], ChatGPT “memory” is limited by the context and amount of information it can track in a determined ongoing conversation. Even if the course designers tried to complete these tasks in the same ChatGPT conversation thread, they would still have similar issues due to ChatGPT’s inability to recall all the assessments it had already generated. ChatGPT has experienced considerable growth and advancements since its launch, according to the most recent empirical data, the working memory capacity of the model currently mirrors that of human working memory. This implies that although there have been notable enhancements to the model’s overall capabilities, the fundamental structure of working memory capacity has remained relatively stable since 2022 [13]. Consequently, because it cannot recall this information, ChatGPT will make things up, in other words, a state called “hallucination.” This is a state in which ChatGPT (and other AI chatbots) will fabricate content

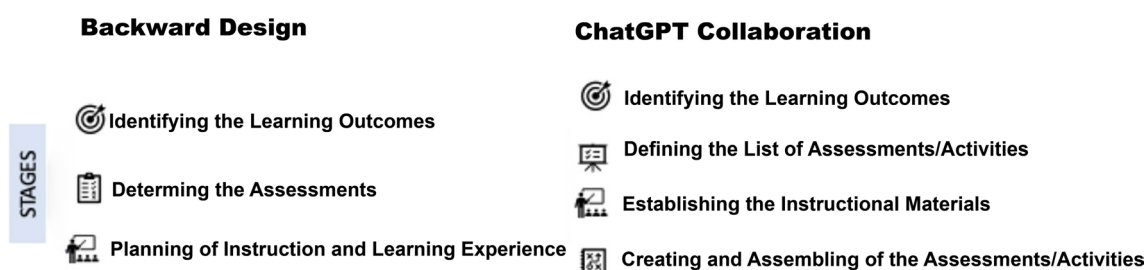


Fig. 2 Backward design model and the ChatGPT collaboration stages



or information to get the task completed [38]. In this case, ChatGPT would create instructional materials not associated with the assessments it had already created. Although ChatGPT hallucination is not fixable at the moment, the best way to address ChatGPT “memory” capacity is to include previous conversations in prompts or provide a summarization of the content [6]. To address the AI ‘hallucinations’, we used Human in the Loop (HITL) strategy that involves human oversight and intervention [54]. In contrast, when humans design course content, the learning outcomes are used to derive the assessments and instructional materials. Given a person’s cognitive capacity to recall previous information, the Backward Design stages can be followed. However, when course designers use ChatGPT to collaborate in course development, they need to specify the instructions (e.g., including previous conversations in prompts) and content (e.g., generate the instructional materials first before the assessment) so the tool will know what to generate. Thus, the course designers for this project followed the stages below, integrating principles of Backward Design in a ChatGPT collaborative framework, which we call *CHAT-IDEA* (see Table 3).

The framework combined the course designers’ steps in collaboration with ChatGPT to create the course. Backward Design principles were also used to guide the course designers’ main steps in generating the course (see Fig. 3). In the next section, we have a detailed explanation of the entire process.

### 4.3 Identifying learning outcomes

In the TIID course, the design team determined that the module structure for the course would be a 2-week module, which led to the design and development of seven modules. One of the first steps taken by the team was to ask ChatGPT to develop a comprehensive list of trends and issues in Instructional Design. The instructional designers reviewed the list and revised the topic list from sixteen to six. Next, we asked ChatGPT to create a course description for a Master’s level course in an Instructional Technology program on Trends and Issues in Instructional Design and provided the list of six topics. Once the course description was complete, ChatGPT was asked to write the course goals. To develop the course goals, prompts were refined to include the following terms: *Bloom’s taxonomy*, *create course goals*, and *course description*. When instructing ChatGPT to generate the course goals, it is imperative to make specific measurable requests. For example, the first prompt was to *create course goals for an Instructional Design graduate class on Trends and Issues in Instructional Design with the following Course Description: [course description]*. This produced outcomes with specific topics and used verbs such as ‘learn’ and ‘understand’. The second prompt was more specific. *Using bloom’s taxonomy, create course goals for an Instructional Design graduate class on Trends and Issues in Instructional Design with the following course description [course description]*. This prompt ensured the course goals were written in an outcome-oriented manner. The verbs changed to ‘recall,’ ‘explain,’ and ‘analyze.’

From the six goals ChatGPT provided us, we revised the wording and created three overarching course goals. We took each topic along with the course goals and prompted ChatGPT to develop module objectives. An example of the first prompt was: *For a graduate level Instructional Design class on Trends and Issues in Instructional Design, create objectives for a module on foundations of educational technology and covers 1. pedagogical shifts and adaptations 2. issues in instructional technology: accessibility and digital equity.*

We refined the prompt to include using *Bloom’s taxonomy verbs* to ensure the module objectives were measurable. Additionally, we had to refine the prompt again to include the timeframe and the number of objectives. An example of the second prompt was: *For a graduate-level Instructional Design class on Trends and Issues in Instructional Design, create objectives using Bloom’s verbs for a module on foundations of educational technology and cover pedagogical shifts and adaptations issues in instructional technology: accessibility and digital equity; it is a 2-week long module with 2 to 3 outcomes.*

**Table 3** CHAT-IDEA—course design model for ChatGPT Collaboration

Collaboration with ChatGPT	Stages
C: Creating the learning outcomes for a course with prompts to ChatGPT	I: Identifying the learning outcomes of a course
H: Harnessing ChatGPT capabilities to define a list of assessments and activities for a course	D: Defining the list of assessments and activities based on learning outcomes
A: Asking ChatGPT to create the instructional materials for a course based on the learning outcomes initially generated by the tool	E: Establishing the instructional materials
T: Tailoring the assessment and activities with ChatGPT based on the instructional materials previously generated by the tool	A: Actual creation and assembling of the assessments and activities based on the instructional materials



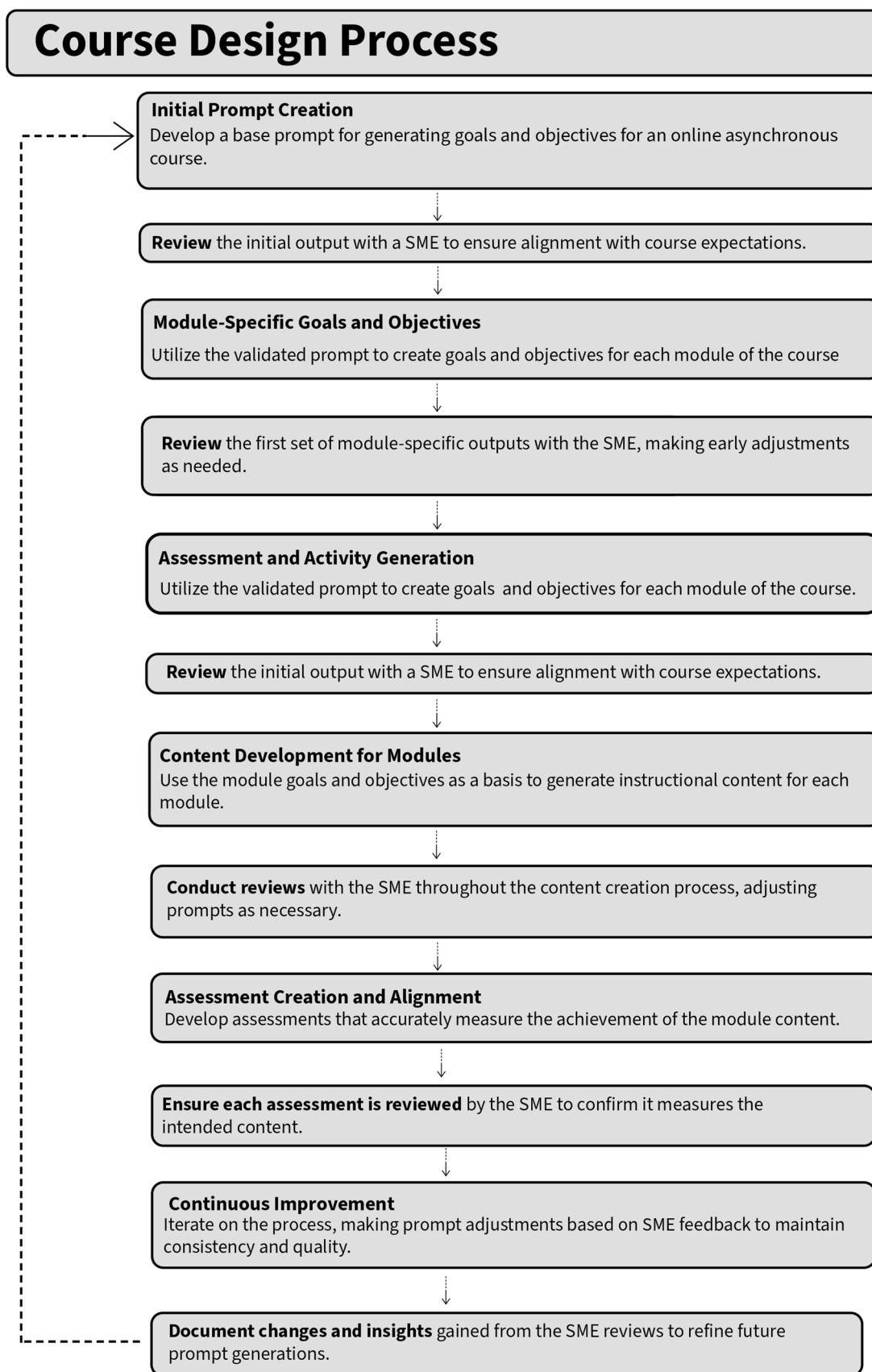


Fig. 3 Course design process

Dickey and Bejarano [10] also used this method to develop course learning outcomes. It is crucial to tell ChatGPT to act like a person (persona pattern), give the learner's level (audience pattern), use Bloom's verbs, and the number of objectives required. The more precise the prompts are, the greater the chance for the outputs to be more relevant for the user. As ChatGPT generated the objectives, reviewing and revising them for quality and accuracy was important. For example, if some objectives need rewording, additional prompts such as "I like learning objectives 2 and 3 but reword objective 4 to be a lower level in the cognitive process of Bloom's taxonomy." Additionally, it is important to let ChatGPT know if you edited the model it provided, even if you do not want feedback. This allows the LLM to learn your preferences during a session [10]. The time spent creating the course goals, course description, topics, and module objectives, including human revisions, was about 1 h. This significantly assisted with the course design process by reducing time spent on the course structure.

#### 4.4 Defining assessments and activities

Next, to stay organized, we created a course map (Table 4). We then took the module objectives and asked ChatGPT to develop assessments/activities for each module. The assessments were added to the course map. We used a number system (e.g., 1.1, 2.1, 3.1) for module objectives and ensured each assessment item was appropriately aligned to the module objectives, which were aligned to the course goals. ChatGPT successfully brainstormed the assessments and activities aligning with the module outcomes.

#### 4.5 Establishing the instructional materials

The instructional content took the most time to develop and find the best prompts and create the materials. This iterative process took more prompts with specific requirements. Although much of the instructional materials came from various sources (e.g., scholarly articles, blogs, LinkedIn Learning), we still wanted instructor-created lecture videos for each module to establish instructor presence. Creating the PowerPoints, which included slides and scripts for the instructor to create an asynchronous lecture, took the most time. We had to go through five iterations to find the best prompts to get the desired output. The content had to be fact-checked and then added to a PowerPoint. To create the base for the instructor-created lectures, ChatGPT was prompted with a persona prompt: *imagine that you are a university professor and write a comprehensive article that identifies and describes key pedagogical shifts that occur with the use of educational technology and cite the summary*. The prompt was then changed to *write a comprehensive summary that identifies and describes key pedagogical shifts that occur with the use of educational technology and cite the summary*. We still did not get the optimal output to generate a PowerPoint. The prompt was then changed again to *imagine that you are a university professor, write a PowerPoint presentation for a graduate Instructional Design class that covers [topic] in relationship to the field of Instructional Technology*. That output gave us each slide with the bullet point topics to cover but not a script to read for creating a lecture video. The next prompt asked ChatGPT to *generate notes for each slide*. This, again, did not produce the ideal output as it created bullet point sentences, and the content was still minimal. ChatGPT was then asked to go into more detail regarding the overall topic. Again, we were dissatisfied with the results. Another approach was taken to ask ChatGPT to go into more detail for each slide. The prompt was then *can you go into more detail [insert slide prompt bullets]*. The output was reviewed and approved, and the desired results were obtained. Once we had a process of asking ChatGPT to (1) write a PowerPoint presentation for a given topic and (2) ask ChatGPT to go into more detail for each slide, the process of creating each PowerPoint took about an hour, including review, revision, and the time it took to copy and paste the information into the PowerPoint.

#### 4.6 Development of assessments and activities

Many assessments were comprehensive, typically consisting of a short paper, presentation, or case study discussion. For the case studies, the first prompt was to *Create a case study for graduate students based on the following [content for module]*. ChatGPT produced a case study along with the analysis of the case it provided. Therefore, the prompt was changed to: *give an example of a good case study prompt for graduate level students about [topic]*. Once the word 'prompt' was added, ChatGPT gave a scenario, questions to ponder, and instructions for student expectations.

There were many iterations of the prompts to develop the quizzes for the course. Multiple choice quizzes can be time-consuming when developing the questions and answers. Additionally, getting a quiz into the LMS can take time due to copying and pasting the questions and answers, particularly for multiple-choice assessments. ChatGPT was able

**Table 4** Example of alignment table

<i>Module 1: Foundations of educational technology</i>	<i>Outcomes</i>	<i>Learning materials</i>	<i>Activities/assignments/assessments</i>
	1.1 Identify and describe key pedagogical shifts that occur with the use of educational technology (CG 1) 1.2 Analyze the impact of educational technology on teaching and learning. (CG 2)	Key pedagogical shifts Presentation (MO 1.1)	Online presentation (MO 1.1, 1.2)

to generate appropriate quizzes and identify the correct answer. The original prompt was: *Create a quiz for the following objective: Define key terms related to augmented and virtual reality.* This produced the quiz, but they were not always aligned with the content. Additionally, we also wanted the quizzes formatted so they could be imported into the LMS using Respondus software. To achieve this, the quiz had to be formatted correctly with question numbers and an asterisk on the left side of the correct answer. The formatting was lost when the quiz was copied and pasted from ChatGPT, and the course designer would have to reformat the document. The prompting was changed to 'prime' ChatGPT. The first prompt was, *are you familiar with the Respondus 4.0 application?* The next prompt asked ChatGPT to format a quiz for Respondus that could be copied and pasted into a text file, and a summary of the instructional materials was provided to ChatGPT to ensure alignment between the content and the quiz questions. Finally, ChatGPT was told to produce it in *code block format*. ChatGPT provides a plain text editor (see Fig. 4), allowing the user to copy and paste from ChatGPT without losing the formatting by clicking on the copy code button in the top right. Once the prompting was configured, each quiz took about 30 min to create, review for accuracy, and import into the LMS.

Once all the assessments were developed, the instructional designers reviewed and revised them. At that point, ChatGPT was asked to create rubrics for the assessments. The rubrics consisted of the following criteria: depth of analysis, integration of course content, critical thinking, quality of peer interaction, clarity and communication, and overall contribution (see Fig. 5). Each rating included a clear description from exceptional to limited. When creating rubrics using ChatGPT, it is important to ensure that the tool is informed about the total point value of the rubric to be generated. On the first try of creating a rubric, ChatGPT assigned 30 total points. The next prompt was *could you do the same thing only make the point value out of 100*. One important note is to ensure the assessments have been revised before creating the rubrics to ensure the rubrics are aligned with each assessment. Overall, the assessments, including the rubrics, took about 10 h to design, develop, revise, and import into the LMS.

#### 4.7 Course development

Once we had all the content, the course still needed to be created in the LMS. Creating responsive and accessible pages in the LMS takes using certain HTML/CSS/JavaScript structures for the LMS platform. Many LMSs have their own APIs and specific ways to integrate custom content and styles. ChatGPT can generate HTML, CSS, and JavaScript for Moodle, Canvas, Blackboard, and Google Classroom [40]. Using ChatGPT, we created responsive pages within our LMS (i.e., Canvas) (see Fig. 6).

To create the overview page, the first prompt was to *create an interesting ADA accessible Canvas LMS page using CSS grids that include the following [insert content with objectives]*. Initially, we found the content layout needed to be more modern. The next prompt was *Create an interesting looking responsive CSS grid for an overview page for an online graduate class that includes the following [insert content]*. The user cannot use external CSS styles when creating a page in the Canvas LMS. Instead, CSS needs to be inserted directly within the HTML code. This is necessary to ensure that Canvas does not remove the styles from the page, and in most prompts, there was the need for a follow-up prompt asking to put the CSS inline with the HTML. The last prompt produced the Canvas page, as seen in Fig. 6. Once the code was established, it was copied and pasted into the Overview pages, and the content was subsequently copied and pasted into Canvas. This process required someone with knowledge of HTML to adapt the prompt for the desired output. Once the desired code was established, it took the designers approximately 30 min to create all the overview pages in the LMS.

### 5 Discussion

We learned many valuable lessons regarding collaborating with ChatGPT to create an entire course from scratch. First, establish a plan for documenting the collaboration process with ChatGPT. It is important to keep track of the prompts to know which ones successfully provided the desired output in the course design and development. The documentation can become a long and tedious process, but it might be necessary for all stages of the process, especially to ensure alignment among the course goals, assessments and instructional materials generated for the course. If the information is well documented and organized, it will be easier to find the needed information later. When we began this process, we had to copy and paste the prompt and response into a Word document. During the process, ChatGPT was updated with a 'share link.' This reduced the time spent copying and pasting and allowed us to create separate documents for Objectives, Assessments, Content, and Rubrics. Designer notes were also included about the content being created, and the share link was added to the document. This allowed us to revisit the session within ChatGPT and review the process we

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Quiz Title: The Importance of Accessibility and Digital Equity in Instructional Technology

Instructions: Please select the correct answer for each question.

Question 1:
In today's digital age, what does instructional technology offer in education?
a) Opportunities for learning and teaching
b) Opportunities for physical exercise
c) Opportunities for artistic expression
d) Opportunities for cooking lessons

Correct Answer: a) Opportunities for learning and teaching

Question 2:
What is the primary focus of accessibility in instructional technology?
a) Promoting digital equity
b) Accommodating diverse learners, including those with disabilities
c) Enhancing learning outcomes
d) Compliance with legal and ethical standards

Correct Answer: b) Accommodating diverse learners, including those with disabilities

Question 3:
What does digital equity focus on?
a) Compliance with legal and ethical standards
b) Promoting digital literacy
c) Ensuring fair and equal access to digital resources
d) Ensuring access to physical resources

Correct Answer: c) Ensuring fair and equal access to digital resources
```

Fig. 4 Example of code block format with a 'copy' button



<b>Clarity and Communication</b>	Student's writing is exceptionally clear, organized, and coherent. Ideas are effectively structured, and arguments are supported by evidence.	<u>Student communicates</u> ideas clearly and coherently. Writing is well-organized, making it easy to follow their train of thought.	<u>Student's</u> writing is generally clear, but some organization and coherence issues may be present. Arguments are not always effectively supported.	<u>Student's</u> writing is somewhat unclear and disorganized, making it challenging to follow their arguments. Lacks effective support for points.	Student's writing is unclear, disorganized, and difficult to understand. Arguments are poorly articulated and lack support.
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Fig. 5 Example of rubric criteria generated by ChatGPT

### In this module...

In this module, we will delve into the fundamental principles that underpin the integration of technology in education. We will explore how educational technology is reshaping pedagogy, its impact on teaching and learning, and the critical considerations of accessibility and digital equity. Through engaging discussions, readings, and hands-on activities, you will gain insights into the dynamic intersection of technology and education.

### Learning Outcomes

- Identify and describe key pedagogical shifts that occur with the use of educational technology. Understand how technology has transformed traditional teaching methods, paving the way for student-centered, interactive, and collaborative learning experiences. (1.1)
- Analyze the impact of educational technology on teaching and learning. Explore the benefits and challenges of incorporating technology into educational practices, and evaluate how it influences cognitive development, engagement, and knowledge acquisition. (1.2)
- Explain the importance of accessibility and digital equity in instructional technology. Recognize the ethical and practical implications of ensuring that technology-enhanced education is accessible to all learners, regardless of their abilities or socio-economic backgrounds. (1.3)

### Readings/Videos

- Review Instructional Content in Canvas
- Watch the Instructor created lecture

### Quiz

- [Mod 01: Foundations of Ed Tech Quiz \(MO 1.1, 1.2, 1.3\)](#)

### Assignments

- None

Fig. 6 Example overview page in canvas using code generated by ChatGPT

took to obtain the desired output. (e.g., <https://tinyurl.com/2t2ar8zs>). Table 5 presents a synthesis of the collaboration with ChatGPT as well as findings and recommendations discussed in this section.

Next, if the course goals are not already established, they must be determined before moving to the course description, which involves the stage "I" presented in the process of collaboration with ChatGPT. Once this step has been completed,



**Table 5** Synthesis of collaboration with ChatGPT

Collaboration with ChatGPT	Findings and recommendations
Course design and development	Instructors and instructional designers can collaborate with ChatGPT to generate topics for a course, create course description, course goals and module objectives, list of assessments and activities, resources for instructional materials, outline for video lectures, instruction for assignments and activities
Challenges	Instructors and instructional designers must be precise in their prompts to achieve the desired output. Collaborating with ChatGPT also requires multiple iterations for refinement and accuracy of the information provided by the tool
Guidelines for an effective collaboration	Instructors and instructional designers can: 1) pre-plan for the collaboration (e.g., What is the end-goal of this collaboration? What is the result to be expected), 2) provide clear, precise and contextual prompts to ChatGPT to generate better outputs, 3) use conversational language with ChatGPT, specially to indicate preferences, 4) refine prompts when receiving undesired outputs, 5) create prompt library to document the prompts used and outputs generated, 6) use the output generated by ChatGPT to create the course map for the course and 7) follow the CHAT-IDEA process to optimize the course design and development with ChatGPT
Warnings and limitations	Instructors and instructional designers need to be aware that this collaboration is not a one-time approach. Multiple iterations are necessary for refinement and desired outcomes. Additionally, the outputs from the tool can focus more on the quantity than the quality, which leads to necessary revisions and refinement of information. It is also important to work with a SME in the process for information accuracy. The collaboration with ChatGPT is still limited to a single input–output (i.e., text generates text) so it cannot be used to produce visuals or other multi-media content. Finally, the tool is unable to make qualitative judgment and can plagiarize and provide biased information, thus, the importance of human collaboration
The added benefit of this collaboration	It can decrease the design and development time and generate initial ideas for a course. The collaboration can assist instructors and instructional designers to generate measurable objectives, list assessments and activities based on the objectives, the outline and content for instructional materials

the next step is to create a course map. The course map can organize all course goals, module objectives, instructional materials, and assessments in a readily accessible document. Although the Backward Design process states that the assessments should be created after objectives have been defined, when collaborating with ChatGPT, it is important to have the instructional materials to ensure alignment between the assessments and the instructional materials. Therefore, we had to backtrack after creating the assessments, and create the instructional content before creating the assessments. Thus, the necessity of having stage “E” followed by stage “A” in the process of collaboration with ChatGPT. This is an important part of the process because the instructional content is needed as part of the prompt to create the assessments, whether quizzes, case studies, or written projects/presentations [33]. Once the assessments are reviewed, revised, and confirmed by an SME, rubrics can be created using the assignment/assessment description. When we started the process, we created the assessment and immediately created a rubric before the assessments were revised. As a result, we had to re-create many of the rubrics.

It is also important to remember there needs to be an SME to review all content ChatGPT generates [19, 34, 39]. For instructional designers working with faculty to create courses, clearly understanding the discipline-specific jargon is essential to ensure ChatGPT will provide the preferred output. One of the major issues with content generation by AI is authorship attribution [30]. Faculty and instructional designers should also not rely blindly on AI-generated content, given that the tool may use copyrighted material without providing the proper attribution or licensing, which is a form of copyright infringement [42]. For instance, it might be difficult to know the extent to which the AI-generated data is a result of its training set (e.g., the work of others being input in the tool) or otherwise used in the output generated by the tool [9, 30]. Moreover, the output generated by the AI tool can be unreliable and inaccurate [26], which requires revisions by human experts to ensure quality, reliability, and accuracy. Therefore, all the output ChatGPT generates needs to be reviewed and revised not only by the authors, but also by an SME [34]. Moreover, ChatGPT is not designed to replace human expertise. Instructors are advised to use their own expertise and judgment and approach these technologies as a supportive tool to enhance instruction rather than to replace it.

While collaborating with ChatGPT provides valuable insights into the course design process and the effectiveness of the course (e.g., content, assessments, and activities), it is important to acknowledge the potential limitations. First, the course’s effectiveness, including the content’s alignment with the assessments, was not tested, as it was out of the

scope of this paper. Therefore, it is unknown how well the alignment of the content to the assessments and activities performs compared to a course designed without the assistance of ChatGPT. We have not incorporated information on students' perspectives as this is an area of ongoing research. Additionally, the ethical use of AI-generated content, including copyright, should be addressed in future research. These limitations suggest that further research and examination are needed to fully understand the potential of ChatGPT in higher education and how to use it ethically and effectively.

## 6 Conclusion

### 6.1 Key findings

We sought to answer the following questions:

1. To what extent will a collaboration with ChatGPT assist in reducing the amount of time to design and develop a new course?
2. What is the process involved in course design and development with ChatGPT collaboration?

The integration and expansion of artificial intelligence technologies, such as ChatGPT, offer both promising prospects and daunting difficulties for educators, instructional designers, and researchers. This study investigates the employment of ChatGPT 3.5, a specific type of LLM, in the design of an online, asynchronous course for a Master's program in Instructional Technology. Through a multi-phase design process, the teamwork between instructional designers and ChatGPT showed a considerable decrease in the time required for content development to approximately 55 h. This reduction was notable in the context of course creation. Moreover, we found it crucial to develop the instructional materials before designing the assessments and activities, which necessitated an adjustment to the process when collaborating with AI.

### 6.2 Implications

Two key areas were the focus of this collaboration: prompt engineering and content revision. Through clearer and more specific instructions, instructional designers were able to improve the performance of ChatGPT. Moreover, the revision of AI-generated content ensured the accuracy and quality of the information. To further optimize the outputs of LLMs, the use of various prompt patterns, such as persona, audience, and fact checklist, can significantly impact their performance for diverse purposes and audiences.

The course development process outlined in this paper emphasizes the importance of aligning objectives, assessments, and instructional materials to create a coherent and effective learning experience. Collaborating with ChatGPT can assist instructional designers and instructors in generating course goals, module objectives, assessments, rubrics, and instructional content, streamlining the course development process. The iterative nature of working with ChatGPT allows for prompt refinement and a more efficient course design process in terms of time. Integrating LLMs in the course development process can transform how educational content is generated and optimized.

### 6.3 Future considerations

In order for education and instructional design to remain relevant and effective in the face of technological advancements, it is crucial to incorporate innovative tools and refine collaborative approaches. Although this paper's focus was not on copyright issues related to AI, it is important for faculty and instructional designers to exercise caution when utilizing content generated by these platforms, as some do not provide source information. As AI systems become more involved in creating course materials, questions arise about the authorship and ownership of these AI-generated works, and whether existing copyright laws can or should recognize AI as authors or rights holders [5, 36]. Interestingly, while AI can enhance the educational experience, it also relies on large datasets, including copyrighted works, to function effectively. This reliance raises concerns about the fair use of copyrighted materials and the need for proper remuneration for original authors [15]. Moreover, the potential for AI to inadvertently infringe on copyright through the creation of similar works highlights the need for clear legal frameworks and ethical guidelines [36]. In summary, the future of AI in course design and development must address the balance between fostering innovation and protecting intellectual property. This involves adapting copyright laws to account for AI's role in content creation, ensuring fair use and compensation

for original works, and establishing a legal and ethical framework that recognizes the collaborative nature of AI and human educators [5, 43]. As AI continues to evolve, stakeholders must engage in ongoing dialogue to harmonize these considerations with the dynamic landscape of digital education [36]. To ensure proper attribution and address potential copyright concerns, it may be advisable to use platforms that offer references.

## 7 Limitations

This case study commenced in December of 2022. Since then, ChatGPT has experienced significant transformation. The researchers involved in this project were not ChatGPT specialists, which resulted in a considerable amount of trial and error in terms of prompting to achieve the desired outcomes. Furthermore, prompt engineering was still in its early stages. It is important to note that this was an experimental project, and copyright was not considered during the design and development phase. The researchers explored the potential for collaboration with ChatGPT and had to rework all assessments and activities since the instructional materials were not created initially. Once the instructional materials were developed, the assessments and activities could be designed to align with the course goals, module objectives, and instructional materials. Therefore, the researchers focused on the time it took to create usable course materials. Furthermore, the time required to develop a course utilizing artificial intelligence may be extended for certain instructors, as the researchers involved in this project were experienced instructional designers with extensive familiarity in using the LMS.

**Author contributions** S.C and T.D conceived and planned the project. T.D. carried out the design and development of the actual project and documented the steps taken. Additionally, T.D. created the figures in the manuscript. S.C. and D.B. wrote the manuscript based on the documentation provided. All authors reviewed and edited the final draft.

**Data availability** No datasets were generated or analysed during the current study.

## Declarations

**Competing interests** The authors declare no competing interests.

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