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The role of AI chatbots in scaffolding: Linking learning outcomes with assessment

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Abstract

Emerging discussions highlight the role of chatbots in education, which centres around fundamental perspectives concerning technology as either beneficial or an unnecessary disruption to the learning and assessment processes. However, it is crucial to recognise that no technology can be deemed value-neutral, and technological euphoria often blinds us to the unintended consequences of its use. Hence, there is a need for a practical understanding informed by value-based perspectives to comprehend how the encoded experiences created by ChatGPT transform the teaching of students. This article makes a significant contribution to the field of educational research, as only limited attention has been given to higher education students' reflections on the pedagogical use of artificial intelligence (AI) chatbots for learning and assessment.

The article discusses, through empirical findings, the constructive alignment between learning objectives and assessment when employing AI chatbots. The data collection process revolves around students' reflective experiences while utilising the potential of ChatGPT, which are subsequently analysed through focused group interviews. The paper, informed by these observational data, presents a conceptual framework for teachers to employ and assess ChatGPT as a means to scaffold learning among students.

Chatbots rolle i undervisningen er ofte betragtet som enten gavnlig eller en unødvendig forstyrrelse i lærings- og vurderingsprocessen. Ingen teknologier er værdineutrale, og teknologisk eufori gør os ofte blinde for et utal utilsigtede konsekvenser af deres brug. Der er behov for en mere praktisk forståelse og værdibaserede perspektiver på, hvordan de kodede oplevelser skabt af ChatGPT ændrer undervisningen og studerendes læringsforløb. Denne artikel bidrager til dette forskningsfelt, da der indtil nu kun har været begrænset opmærksomhed på studerendes refleksioner over brugen af AI Chatbots på de videregående uddannelser.

Artiklen analyserer etiske og pædagogiske perspektiver på videregående uddannelsers AI anvendelse i den pædagogiske praksis gennem casestudiet. Empirien er baseret på fokusgruppeinterviews og centrerer sig om de studerendes reflekterende oplevelser, tanker og følelser i relation til brug af ChatGPT. Artiklen konceptualiserer fundene i en begrebsramme for undervisernes til brug for vurdering af ChatGPT til at stilladsere læring hos de studerende.

The role of AI chatbots in scaffolding: Linking learning outcomes with assessment

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Introduction

In 2022, the release of Open AI's chatbot ChatGPT marked a significant transformation in the integration of artificial intelligence (AI) within educational contexts, ushering in a new era of AI-supported education. Shortly thereafter, scholarly discourse began to unfold, examining the potential advantages and dilemmas associated with using this chatbot for educational purposes (e.g., Haleem et al., 2022; Sharma & Yadav, 2022). The new AI-assisted era has been recognised as a period of exploration and uncertainty, where the full extent of the latest technological advancements remains to be fully understood. Central to this discourse is the role of chatbots in educational settings, which is often debated in terms of their fundamental value: whether they are perceived as beneficial tools that enhance learning or as unnecessary disruptions to both educational processes and assessment practices.

The integration of AI in student learning has caused concerns within educational institutions, particularly around the evaluation of student output (Cotton et al., 2023). A primary concern is that reliance on AI tools may result in a superficial understanding of academic material, with students potentially depending on AI for task completion rather than engaging deeply with the subject matter. Additionally, if it is not evident that students have independently completed their work, this ambiguity could compromise the integrity of the assessment process, raising questions about the depth of students' academic understanding. Delegating tasks to AI tools without comprehending the underlying processes may lead to shallow learning experiences.

Concerns also arise regarding academic dishonesty, where students might utilise AI to plagiarise or replicate work without proper citation, thereby compromising academic integrity. Furthermore, there is apprehension that AI might replace the development of specific skills crucial for students' personal and intellectual growth. However, recent reviews of AI teaching and learning underscore the importance

of appropriate tools to support pedagogical approaches that scaffold advanced cognitive progression in students (Ng et al., 2023).

Identifying and implementing pedagogies that promote deep understanding and enable the evaluation of students' independent contributions to completion is essential to address these concerns and ensure an equitable assessment reflective of students' true capabilities. Therefore, educators face the challenge of balancing the effective utilisation of AI's strengths while simultaneously ensuring an authentic evaluation of students' effort and learning. The foundation for the current article is rooted in an epistemological approach inspired by constructivist theory focusing on the intersection of AI with pedagogy. Its objective is to explore how pedagogical methods support the development of effective and meaningful learning activities, outcomes (Hassan et al., 2022), and assessments (Biggs & Tang, 2007).

While AI-assisted chatbots present both challenges (Tlili et al., 2023) and advantages (Kasneci et al., 2023; Zhai, 2022) in educational contexts, their introduction significantly transforms students' learning processes and skill development. With the increasing availability of advanced technology, chatbots are consistently being adopted as tools to foster student learning and engagement. However, it is important to acknowledge that no technology is inherently value-neutral, and technological euphoria often blinds us to the myriad of unexpected and unintended consequences of its use (Selwyn, 2011).

As a result, many educators hold reservations about integrating AI tools, stemming from a lack of critical reflection and the necessary design work to align these technologies with the core principles of education (Williamson, 2019). Unfortunately, while it is widely recognised that specific technologies shape the practices and potential of engaged learners, critical reflections on the pedagogical and ethical implications of implementing learning technologies are relatively scarce (Williamson, 2019; Zawacki-Richter et al., 2019).

Through a meticulous analysis of the benefits and drawbacks associated with the employment of AI chatbots from a student-centric perspective, this article delves into the application of the ChatGPT chatbot within educational environments. It presents a pedagogical framework that has been developed from the analysis of empirical data and discusses strategies for the effective integration of ChatGPT to positively reinforce the role of AI in educational settings. Consequently, the research question guiding this article is as follows:

Research question: How do students perceive the role of educators in facilitating their use of ChatGPT to enhance learning and the evaluation of learning outcomes?

Addressing this question requires a deep understanding of students' viewpoints regarding teachers' instructional methods, student learning, and the evaluation of learning outcomes. This approach is necessitated by our adoption of a constructivist perspective on learning. Therefore, an examination of the construction of instructional practices using ChatGPT cannot be conducted without incorporating the viewpoints of students, as they are integral to the learning process and actively participate in shaping instructional activities. We thus acknowledge that the learning process is neither solely an individual task nor solely determined by instruction. Students collaboratively shape and construct their learning environment alongside educators, employing ChatGPT as a tool in this process. Given that our research question explores the notion of scaffolding, it is also relevant to clarify our understanding of this concept. Instructional scaffolding refers to the support provided to learners, enabling them to accomplish tasks that would be unattainable without such assistance. Scaffolding enhances learners' independent capabilities and is employed to assist them as required (Driscoll, 2000).

In answering the research question, we will employ suitable methodologies, which will be elaborated in the subsequent description of the methods used.

Methodology

The study aims to address the research question using a specific case study where ChatGPT has been implemented to examine its alignment with learning objectives. The primary objective is to develop conceptual frameworks that integrate ChatGPT as a vital component of the learning experience. The case study focuses explicitly on a teaching course that allows students to consciously shape their academic path

by immersing themselves in a selected profession-relevant topic and gaining expertise in that area. The ultimate goal is to enable students to independently contribute to the professional and methodological advancement of their selected profession through research-informed knowledge pertaining to one or more relevant topics.

The case chosen for this study is the Architectural Technology and Construction Management (ATCM) programme at University College of Northern Denmark (UCN), deemed paradigmatic for its potential to set a precedent in utilising ChatGPT to assist students' academic writing processes. The case focuses on architectural and construction management education classes during their third, fourth, and fifth semesters. It has been selected as particularly illustrative for demonstrating the impact of introducing a technology such as ChatGPT, given the emphasis on diverse writing formats within the students' educational and professional journey as construction architects. Furthermore, these students are accustomed to engaging with new technology in various forms, ranging from digital systems to technical drafting. This familiarity with technological innovation enables them to articulate their experiences adequately with such technologies, thereby enhancing the potential for effective communication of their experiences to the research team. The selection of students for the study was based on criteria ensuring a broad representation from the classes and concrete experience with using ChatGPT in their coursework.

According to Flyvbjerg (2006), the selection of case studies should enable researchers to explore events and phenomena in holistic and real-life contexts with minimal control. Thus, case studies are an effective means to capture social processes and evolutions, making them a suitable methodology for mapping complex scenarios where individuals and artefacts interact. They are, therefore, particularly suitable for investigating the students' interaction with and use of chatbots, providing various data collection methods and opportunities for methodological triangulation. Yin (2013) proposed a structured approach to case study research, encompassing the design, data collection, data analysis, and reporting of findings. However, it is important to note that not all data may be recorded in writing, and the final analysis is subject to professional judgement based on available resources. Case stories thus act as empirical evidence, constructing a history centred around a pivotal plot or primary categories analysed through the content structure (Yin, 2013).

This case study adheres to the following steps:

— Case selection: Six cohorts, each comprising approximately 30 students from the ATCM programme during their third, fourth, and fifth semesters, have been selected.
— Data collection: Data were gathered through two focus group interviews, all of whom had extensively utilised the chatbot in their assignments. The data should align with the research question and offer a rich and detailed case description.
— Data analysis: The collected data were methodically analysed to identify patterns and themes. This process involved coding the data, pinpointing crucial concepts or themes, and examining the interrelations between case elements.
— Writing up: The case study findings are evaluated, articulated concisely, and related directly to the research question through a writing process. This includes providing a comprehensive description of the case, an in-depth analysis of the data, and a discussion concerning the implications of the findings.

Data collection predominantly focuses on the students' reflective experiences, perceptions, and emotional responses regarding ChatGPT usage. These reflective experiences are discussed and verbalised through conversations within focus group interviews. The data collection process is primarily exploratory, with an emphasis on comprehending and explaining the phenomenon. The analytical goal is to build theoretical constructs based on empirical evidence, achieved through an ongoing thematic coding process that combines various components.

Thematic coding was used to identify and categorise patterns, themes, and concepts in the qualitative data analysis (see Table 1). This method comprised a thorough examination and review of the data to identify recurrent patterns, topics, and notions, followed by the creation of codes or labels to systematically categorise and structure these identified themes. These codes may be descriptive or interpretive, depending on the desired level of abstraction. The thematic coding procedure is instrumental in identifying similarities and variances within the data, thereby facilitating the generation of insights, the development of theoretical frameworks, and the formulation of conclusions (Boyatzis, 1998; Saldaña & Omasta, 2016).

Table 1.
Overview of the thematic code categories retrieved from the empirical data.

Code categories	Number of statements	Code description	Axial coding	Description of axial codes
Critical approach	14	Students demonstrate awareness of AI's limitations and articulate a critical approach to knowledge acquisition and interaction with the chatbot.	The students' statements suggest a need for cognitive support in fostering transparency, ethical considerations, and a critical attitude in their learning.	**Cognitive perspective** This involves considering issues related to transparency, ethics, and a critical attitude.
Lack of knowledge	4	Students highlight the chatbot's limited knowledge in their professional area, necessitating a critical approach.		
Source validation	3	In this category, the importance of validating the sources provided by the chatbot is emphasised.		
Transparency and ethical filters	5	Students express the importance of transparency in the chatbot's knowledge sources and the application of ethical filters affecting its responses.		
Conversation partner	8	AI is used as a conversational partner, described as a professional partner in the learning process that enhances autonomy.	The students' statements indicate a requirement for pedagogical support, emphasising the importance of diverse learning activities that guide their educational journey.	**Pedagogical perspective** This includes a focus on aspects such as engagement and training, along with the provision of necessary resources and support.
Writer's block	2	Students discuss using AI to overcome writer's block.		
Context comprehension	7	This code requires students to comprehend the context when using AI.		

Brainstorm	4	In these statements, students discuss how AI can be used as a tool or partner for brainstorming.	The students' statements indicate a requirement for pedagogical support, emphasising the importance of diverse learning activities that guide their educational journey. This approach is notably practical, designed to foster engagement and enrich learning experiences while also providing essential resources and support.	**Pedagogical perspective** This includes a focus on aspects such as engagement and training, along with the provision of necessary resources and support.
AI as Google Translate	3	Students discuss their use of AI for translating articles, comparable to their utilisation of Google Translate.		
AI as a text rewriter	10	This category includes descriptions of how students use AI to reformulate existing text, aiming to improve their written presentation.		
AI as a search engine	10	Students describe using AI as a tool to search for literature based on theories.		
Analytical exploration	1	They describe using AI to conduct an analysis based on collected data or literature.		
Introduction to AI	10	These statements emphasise the importance of an introduction to AI from the teacher, which is crucial for developing a critical approach.	The students' responses suggest a necessity for an enhanced educational approach where a well-defined framework and criteria for engaging with AI are established, enabling effective assessment of student learning.	**Educational perspective** This involves considering issues related to the broader educational context in which chatbots are being used, including the specific goals and objectives of the course or programme, the students' needs and abilities, and the resources and support available.
AI as a time-saving tool	4	The statements illustrate AI's role as an efficiency enhancer in learning activities, notably in literature research, awaiting teacher guidance, and data management tasks.		
AI as a personal supervisor	10	Students describe how AI assumes the role of a supervisor in their learning process, where they can seek specific clarifications on theoretical concepts and methodologies.		

Problem-solving engagement	4	The students' accounts reveal how engaging with complex problems fosters the development of distinct and personalised work, even when integrating the GPT chatbot.		

Table 1 illustrates the frequency with which these thematic codes are addressed in the empirical data and includes an in-depth description of the axial coding process.

Analysis of the empirical data

In the following section, we present an analysis of selected empirical data, utilising a thematic coding framework as outlined in Table 1, alongside the number of statements. The analysis is based on interview data sourced from students in their fourth and fifth semesters. The focus is on code categories that are represented by 10 or more statements in the empirical data. This selection criterion is necessitated by the page limitations of this article, which prevent a comprehensive analysis of all themes. Additionally, the analysis occasionally encompasses multiple code categories due to their interrelated nature.

AI for rewriting and feedback: The imperative of a critical approach

The initial statement evaluates the utility of the AI-powered language model, ChatGPT, in enhancing students' writing abilities and increasing the professionalism of their expressions. The students acknowledge its proficiency in offering alternatives for vocabulary and phrasing, which aids in refining their writing skills towards a more professional and academic style. In the following statement, a student elaborates on their propensity to use colloquial language and the desire to refine their writing to a more formal academic level:

> [...] Then you say, 'Would you be kind to rewrite this in neat academic language?' Then it actually does that, and the more times it does that for you, the more naturally you read it through and begin to reflect on the text that you have written yourself. You consider what words you use, sentences, and other details. In this way, one's own language becomes nicer, as it's not just spoken language.

This reflection indicates that requesting ChatGPT to provide more academic rephrasing aids in developing writing skills. Engaging with examples of academic language prompts the student to critically evaluate their style, choice of words, and sentence construction, thus refining their written expression to be more sophisticated and distinct from spoken language. Additionally, another quote explains how ChatGPT helps diversify their writing to avoid repetition, thereby enhancing their conceptual understanding:

> Well, can you rephrase this so that you might have the opportunity to do it instead of just continuing to repeat yourself? So, it develops – what should one say – the scope of what you can write about, I think.

By using ChatGPT for formal rephrasing, students encounter new vocabulary and sentence structures and learn writing conventions not previously familiar to them. This exposure is crucial for authentic learning relevant to real-world applications. Moreover, the feedback and guidance from ChatGPT facilitate a dynamic process of writing and revision, which is essential for deep learning and mastering the complexities of effective writing. Collectively, these insights demonstrate the significant potential of AI-powered language models in not only refining writing skills but also in equipping individuals with communication skills vital for real-world scenarios.

AI as a search engine: Streamlining source selection and providing guidance in academic research

In the following excerpt, the students discuss their utilisation of the ChatGPT language model to refine their research focus and identify pertinent sources. They characterise the model as a valuable guide that aids them in identifying a range of possibilities related to specific topics, providing them with an overview of different theories and methods for further exploration:

> […] So, we've mostly used it to narrow down instead of scouring the internet empty for theories and methods. You can ask, 'Okay, what would be suitable here?' and then it comes up with 7–8 different options. At the same time, you can get pros and cons for each if you request it. It's like having someone with insight advise, 'We should use this option because of this reason, or choose that one because it fits better.' So, it saves a lot of time when you need to investigate which sources or methods to use for different things.

One significant benefit of utilising ChatGPT is its ability to streamline the research process for students by efficiently identifying relevant sources and offering a range of potential pathways for exploration.

> Yes, but I think it's kind of the same thing, meaning it can guide you onto the right track. In the direction that... it's quite good at that.

Additionally, the students articulate that ChatGPT helps them focus their research and select pertinent information sources. While they do not rely on ChatGPT as a direct information source, they value it as a tool to navigate towards relevant materials for their studies. Nevertheless, it is crucial for students to critically assess the reliability and credibility of the resources suggested by ChatGPT. As a language model based on machine learning algorithms, ChatGPT generates responses informed by the input it receives.

> [...] And we've also found out that it's quite good at providing sources for various things, but you do need to be critical of what it comes up with because it's not certain that you can find that source. Or sometimes it might be a bit more wiki-like.

> [...] Yes, I think it's important to teach the students that they can't just blindly go along with what it says, but that they can use it if they've hit a wall and that they themselves need to be able to find information about the topic they're writing about.

> [...] So we're constantly critical of what we read because, well, we at least experienced an example where it said something that was incorrect. So, everything it writes, in one way or another, we need to be critical of, and we are.

The students thus emphasise the significance of adopting a critical approach, which is a crucial aspect of authentic learning. Their reflections include instances where they critically evaluated and identified inaccuracies in the content provided by ChatGPT. Despite acknowledging the utility of ChatGPT in providing useful information, the students nevertheless recognise the imperative of critical assessment and source verification. Furthermore, they emphasise that learners should proactively pursue knowledge rather than relying solely on ChatGPT's insights. The students advocate for educational approaches that instil critical thinking towards sources and foster independent information-seeking skills, cautioning against the use of ChatGPT as merely a "copying machine" in the learning process.

> [...] Well, I would say that it brings a bit more responsibility for learning because, if you don't care about getting the right or wrong answer, you can just take what the bot says and use it for any purpose. But it's important to be critical of it and also investigate your studies yourself, so it doesn't just become a copying machine because we know we won't learn anything that way. So, I think by using it, it's also important to be very aware that you need to understand what it's saying and be critical of it, not just copy it because you'd also like to learn something.

The statement underscores the necessity for students to adopt a critical stance and independently seek knowledge. These competencies are essential to authentic learning, which prioritises the practical application of knowledge and skills while fostering the development of students as lifelong learners. The student's analysis of ChatGPT's limitations, coupled with the emphasis on analytical evaluation of sources, aligns with authentic learning and assessment principles.

AI as a personal supervisor: Integrating AI support with an analytical mindset

In the following quotes, the students reflect on the use of ChatGPT in comparison to a human advisor or mentor, acknowledging that the chatbot serves effectively as a guide in understanding topics or concepts, as well as its efficacy in delivering specific responses to inquiries:

> [...] It's, you know, easier and faster to ask ChatGPT than to write to a supervisor on Teams, as that supervisor has to go through 10 other groups spread over two semesters. So, it's much faster because then you can move on.

> [...] Personally, I also feel that you get more out of it by asking the bot. Because then you've sort of found the way there yourself. If you figure out how to use it as we've done, well, then you have the right keywords to get there. But if you simply ask a supervisor without trying and they give you all the answers, it doesn't help you in the way you should be researching because the issue of not knowing can come up again. So, it's helpful that you can use the bot to find it yourself instead of having to ask a supervisor every time there's a problem.

However, the students observed that responses from ChatGPT might not invariably be entirely accurate, which necessitates the essential task of double-checking the information provided. Conversely, human

advisors are highly regarded for their capacity to provide comprehensive clarification of concepts and offer personalised guidance. Although ChatGPT can provide direct answers, the students highlighted that human advisors are more adept at delivering detailed explanations and guidance for a deeper understanding of the subject matter. They can aid learners in understanding the reasoning behind their recommendations and offer additional resources. Human advisors are also trusted sources of information due to their educational qualifications and professional experience. However, their availability can be limited, potentially leading to delays for learners seeking immediate answers to their questions.

> [...] Well, I would say it can't be used exclusively as a supervisor because it doesn't have that experience-based aspect that a supervisor who has been working with it for many years has. I mean, there are clearly some personal experiences, whereas this one just goes in and provides an answer.

> [...] You trust a supervisor more, whether it's one-to-one or in a group setting. Partly, it's because they have, well, a solid educational background. You could say you trust them almost blindly with what they say.

Another aspect the students highlighted was the utilisation of ChatGPT to generate ideas, examples, and information related to their topics. The statement indicates that ChatGPT was found advantageous for brainstorming, as it offered a diverse range of ideas and theoretical perspectives that could be used in their subsequent academic endeavours. Nevertheless, it is advisable to integrate ChatGPT with traditional sources such as books and articles to foster a more comprehensive understanding of the subject matter.

> Yes, I also think that when we did some research and asked it to generate different problem statements for us, it could give us an insight into some things we hadn't thought about, like coming up with different ideas for it. And yes, it also helped a bit with finding some sources, though not all were useful, but it could tell us where and in which books we could read certain things and such.

> Sometimes you feel like you're hitting your head against a wall where you don't really know how to move forward, right? And it's good for just asking, for example, 'How do I move on from here? What am I missing?' And then it spits something out, and maybe from all the things it spits out, you find out, 'Aha, that was actually a pretty smart way to go.' It's a bit faster in that sense.

Overall, the students' experiences suggest that ChatGPT was instrumental in boosting creativity, generating diverse ideas, and expanding their comprehension of various topics. However, the effectiveness of interaction with ChatGPT depends significantly on the ability to construct the relevant context. Authentic learning, which encompasses engaging students with real-world challenges and complexities beyond the traditional classroom, is fundamental in this process. In the context of interacting with ChatGPT, the statement implies that students cannot merely input indiscriminate questions and anticipate accurate responses. It is imperative for them to learn the skill of formulating pertinent questions and constructing a relevant context for their inquiries. Proficiency in this context-building process is vital for ensuring that ChatGPT delivers precise and reliable information.

> Yes, that's also what we've found out, figuring out how to write to it. You can't just write anything. It's about finding out how to ask questions. Yeah, it's about figuring out how to ask it in order to get the right information.

The effectiveness of ChatGPT, as previously discussed, depends largely on the user's capacity to provide context and formulate appropriate questions. These parallels bring to the forefront a significant educational challenge: aligning technological tools with educational objectives to foster meaningful and measurable outcomes. Similar to how students must master the art of questioning and context creation with ChatGPT, educators are also tasked with refining their methodologies to successfully integrate AI tools within their teaching practices. As we further explore the data, the concept of "constructive alignment" emerges as a key framework for steering the research. This concept will be explored in greater detail in the subsequent section.

The role of AI chatbots in the constructive alignment of teaching and assessment

The fusion of ChatGPT and AI in educational settings is an emerging trend. Educators should, therefore, contemplate the optimal and ethical application of these tools (Jensen et al., 2022; Tromp et al., 2011). One particular challenge in this domain is the achievement of constructive alignment between student learning objectives and assessment practices. The concept of "constructive alignment", formu-

lated by Biggs (1996), explains the connection between the established learning objectives and their corresponding assessments. As ChatGPT and various AI technologies increasingly influence how students acquire and refine knowledge and skills, it becomes essential to foster constructive alignment in reevaluating the underlying assumptions. This entails a critical review of (1) the educational objectives and (2) the methodologies employed to achieve these goals (Lent, 2017).

Incorporating AI within educational frameworks necessitates addressing both the challenges and opportunities it presents. Designing and scaffolding a real-world context for students is crucial in establishing a constructive alignment between assessment activities and learning objectives, even when chatbots are utilised in the learning process. For instance, programming ChatGPT to simulate interactive discussions or problem-solving exercises could enable students to demonstrate their acquired knowledge and skills in a more dynamic and authentic manner. It is thus essential to thoughtfully consider the learning objectives and ethical implications associated with the use of ChatGPT and other AI technologies. This requires ensuring that the use of chatbots not only supports student learning and engagement but also upholds ethical standards and respects student autonomy. Additionally, the assessment of students' engagement with ChatGPT must be conducted with reliability and fairness. Such critical reflections highlight the necessity of addressing ethical, logistical, and practical considerations when utilising ChatGPT in educational contexts.

Traditionally, assessment in learning has been a tool for regular grading, where teachers' evaluations are predominantly informed by tests or examinations based on standardised criteria (Harlen, 2005). However, with the advent of sophisticated technologies like ChatGPT and other AI systems, the conventional concept of "assessment of learning" becomes insufficient, as a summative form of assessment requires clear expectations and a sole focus on content (Carver-Thomas & Darling-Hammond, 2017; Gasior, 2013; Harlen, 2005; Hughes, 2014). The potential of AI to generate educational content poses a challenge to the traditional summative approach of fairly evaluating students' knowledge and skills. Consequently, there is an emerging need to explore and integrate contemporary assessment paradigms such as "authentic", "performance", "alternative", "ipsative", and "sustainable" assessments. The purpose of these approaches is to complement traditional methods, with the goal of more effectively capturing learning scenarios in an AI-enhanced educational environment.

These novel assessment concepts share a common characteristic: they emphasise assessment *for/as* learning, which provides a more formative character that aims to promote reflection by mapping the development of learning processes. Essentially, assessment for/as

learning is based on the teacher's feedback, focusing on improving the students' learning potential and their capacity for *"self-awareness of learning needs, self-regulation of the learning process, and lifelong autonomous learning and self-determination in decision-making from an ecological and socially responsible perspective"* (Rodríguez-Gómez & Ibarra-Sáiz, 2015, p. 5). The theoretical debate surrounding assessment in education has conventionally centred on two distinct paradigms: *"assessment of learning"* and *"assessment for/as learning"*. This delineation is essentially a choice between formative and summative assessment methodologies (William & Thompson, 2017). According to William (2018), the distinctions between "assessment of", "for", and "as" learning can be succinctly summarised as follows:

Assessment for/as learning is fundamentally supportive in nature.

Assessment of learning, conversely, focuses on measurement.

While assessment for/as learning involves descriptive processes, assessment of learning typically relies on scoring.

Utilising *assessment for/as learning* approach equips students with comprehensive support in navigating both the formal and informal aspects of their learning process. This approach enables deeper analysis and reflection on the connection between their values, experiences, and the development of practical understanding and beliefs. It is imperative that assessment activities accurately reflect the influence of students' behaviours and normative understandings on their ability to develop professional judgement and establish credibility. Within this framework, "authentic assessment" emerges as a particularly effective strategy. This form of assessment involves engaging students in real-world tasks that demonstrate their knowledge and skills, aimed at evaluating students' capacity to apply their learning in genuine, significant settings rather than just memorising facts or completing tasks. Authentic assessment often requires students to produce a product or undertake a project, often incorporating elements of collaboration, problem-solving, and communication skills. However, simply acknowledging the benefits of authentic assessment is insufficient. There is a pressing need to integrate theoretical knowledge with practical strategies, particularly in utilising emerging technologies like chatbots within educational frameworks. In this context, the principle of

constructive alignment becomes essential, serving as a foundation for optimising the use of these technologies in education.

By using *assessment for/as learning,* students gain robust support in addressing both their formal and informal considerations. This approach aids them in analysing and reflecting on how their practical understanding and beliefs are influenced by their values and experiences. Specifically, assessment activities should mirror how a student's behaviour and normative understandings impact their capability to forge professional judgment and credibility. Authentic assessment stands out in this respect. It tasks students with real-world challenges to showcase their knowledge and skills. Rather than mere recollection of facts or task completion, it demands application in genuine, impactful contexts, encompassing facets like collaboration, problem-solving, and communication.

A framework for scaffolding student learning and engagement using AI chatbots

In the integration of AI chatbots within an authentic learning environment, the concept of constructive alignment becomes paramount. Achieving this alignment necessitates the meticulous definition of learning objectives and the thoughtful design of both learning activities and assessment tasks. This process involves navigating pedagogical challenges and framing learning and assessment tasks based on three distinct perspectives. These perspectives, as revealed by empirical data and analysis, include cognitive considerations, a pedagogical lens, and the specific educational context (see Table 2).

Table 2.
An overview of code categories and associated learning activities.

Code categories	Learning activities
Cognitive perspective: This involves considering issues related to transparency, ethics, and a critical attitude	
Critical approach	Engage in critical thinking Reflect on personal biases and assumptions
Lack of knowledge	Promote transparency in learning Provide guidelines Provide comprehensive information Ensure ongoing feedback
Source validation	
Transparency and ethical filters	
Pedagogical perspective: This involves considering issues related to engagement and training, resources, and support	
Conversation partner	Facilitate human interaction
Context comprehension	
Writer's block	Encourage asking questions Ensure the availability of additional resources Provide feedback on progress
Brainstorm	
AI as Google Translate	
AI as a text rewriter	
Analytical exploration	Engage in project-based learning activities Develop and enhance problem-solving skills
Educational perspective: This involves considering issues related to the broader educational context in which chatbots are being used, including the goals and objectives of the course or programme, the needs and abilities of the students, and the resources and support available.	
Introduction to AI	Provide student support and guidance Address technical considerations

AI as a time-saving tool	Monitor students' use of the chatbot
AI as a time-saving tool	
Problem-solving engagement	Integrate AI into the curriculum Facilitate students in setting their learning goals

Table 2 presents an overview of code categories and associated learning activities from cognitive, pedagogical, and educational perspectives.

From the perspective of authentic learning, using a chatbot enables learners to engage with authentic tasks and receive real-time feedback. The students' positive experiences with the chatbot indicate that such tools can effectively familiarise learners with technologies increasingly prevalent in contemporary professional environments. Regarding assessment, the chatbot emerges as a tool for formative evaluation, offering learners ongoing feedback on their progress.

The following section introduces a pedagogical framework (see Table 3) developed through the examination of empirical data and theoretical discourse surrounding ChatGPT. This framework aims to constructively scaffold the integration of AI within higher education settings.

Table 3.
A pedagogical framework for scaffolding the use of AI in higher education.

Code categories	Code categories	Code categories
Cognitive perspective: This involves considering issues related to transparency, ethics, and a critical attitude		
Provide guidelines	Provide students with guidance on effective ChatGPT usage, set boundaries to prevent over-reliance, and encourage the development of critical thinking and problem-solving skills.	It is essential to evaluate whether students' usage of ChatGPT avoids creating underlying value conflicts and sustains ethical engagement.

Provide comprehensive information	Inform students about ChatGPT's capabilities and limitations, ensuring transparency about its role in the learning process.	Educators must evaluate students' understanding to mitigate technological euphoria and enhance awareness of the potential unintended consequences of using ChatGPT.
Promote transparency in learning	Encourage students to log all interactions with ChatGPT, promoting transparency in data or knowledge generation and collection.	Clarity in the assessment process can be achieved by offering transparent insights into students' strategies for interacting with ChatGPT to achieve learning objectives.
Engage in critical thinking	Engage students in problem-solving tasks that foster critical evaluation of the information and guidance from ChatGPT.	There is a need to support students in independently evaluating their learning progress, particularly through problem-solving activities that enhance critical thinking abilities.
Ensure ongoing feedback	Students should proactively address potential issues through continuous feedback and corrective actions, while educators support students in understanding how ChatGPT impacts their learning.	Fostering an environment of trust and fairness is crucial, ensuring that ChatGPT is used as an educational tool rather than a mere solution provider.
Reflect on personal biases and assumptions	Encourage students to consider their biases and assumptions in light of the information provided by ChatGPT.	Students should be encouraged to develop an open-minded approach and a willingness to consider diverse perspectives, enhancing critical understanding of explored topics.
Pedagogical perspective: This involves considering issues related to accessibility, motivation, engagement and training, resources, and support		
Engage in project-based learning activities	Guide students to use ChatGPT in project-based learning, encouraging the creation of projects or products rather than direct solution-seeking from ChatGPT.	Ensuring that students harness ChatGPT to deepen understanding and assist in problem-solving rather than merely obtaining solutions is crucial for optimising the educational experience.
Develop and enhance problem-solving skills	Encourage students to employ ChatGPT in solving problems.	There is a need to empower students to showcase their capacity to effectively utilise ChatGPT, demonstrating the application of their learning in a practical, problem-solving context.

Encourage asking questions	Encourage students to critically evaluate the information provided by ChatGPT by formulating and asking pertinent questions. They should consider the accuracy, relevance, and context of ChatGPT's responses through critical inquiry and cross-reference with other sources.	Asking questions is a powerful tool for promoting authentic assessment and learning. Encouraging learners to ask questions aids them in developing critical thinking skills, promoting active learning, supporting self-assessment, providing feedback, and fostering a sense of curiosity and exploration.
Provide feedback on progress	Collaborate with students to establish clear objectives for utilising ChatGPT and deliver consistent feedback on their progress.	Feedback and guidance on a student's progress support authentic learning by clarifying expectations, identifying areas of strength and weakness, encouraging reflection, supporting goal setting, and contributing to formative assessment processes. Feedback thus helps students develop a deeper understanding of the material and achieve their learning goals.
Facilitate human interaction	Ensure that ChatGPT usage complements rather than replaces human engagement by creating opportunities for students to consult and collaborate with teachers, mentors, or peers.	When using a chatbot, human interaction is crucial for providing emotional support, addressing misunderstandings, promoting critical thinking, offering feedback, and supporting differentiation. By incorporating human interaction into a ChatGPT learning experience, teachers and instructors can create an engaging, supportive, and effective learning environment for all students.
Ensure the availability of additional resources	Offer comprehensive support to students, guiding them towards additional resources and information when ChatGPT's assistance is limited or insufficient.	Providing a variety of resources when using ChatGPT underpins authentic assessment and learning by promoting exploration and encouraging critical thinking. Teachers and instructors can help students develop a deeper understanding of the content by providing access to a wide range of resources and information.

Educational context: This involves considering issues related to the broader academic context in which chatbots are being used, including the goals and objectives of the course or programme, the needs and abilities of the students, and the resources and support available.		
Integrate AI into the curriculum	Align the integration of ChatGPT with the curriculum and course objectives, ensuring its inclusion in lesson plans and assessments to allow students to practise and demonstrate competencies.	Curriculum alignment enhances authentic learning with ChatGPT by focusing on learning outcomes and fostering coherence. Aligning ChatGPT usage with the curriculum enables educators to foster a learning environment that is both effective and engaging.
Monitor students' use of the chatbot	Monitor student engagement with ChatGPT to confirm it complements classroom participation and other interactive forms of learning rather than replacing them.	Monitoring students' use of ChatGPT offers critical insights into their learning process. It serves as a valuable tool for educators, enabling them to identify students' challenges, offer specific feedback, and promote self-reflection, thereby supporting overall student learning and achievement.
Facilitate students in setting their learning goals	Encourage students to set their learning objectives by leveraging the resources provided by ChatGPT, promoting self-directed and goal-oriented education.	Setting learning goals enables students to enhance their sense of independence.
Provide student support and guidance	Provide essential support and resources for chatbot usage, which includes access to training, documentation, and troubleshooting assistance, as well as online guides and dedicated technical support.	Providing students with adequate resources and guidance for using ChatGPT can support authentic assessment and learning by promoting access, engagement, exploration, differentiation, and reflection. By ensuring students receive the necessary support for engaging with ChatGPT and achieving their learning goals, educators can establish a learning environment that is effective and equitable, fostering engagement for all students.
Address technical considerations	Address technical considerations related to the use of ChatGPT, focusing on data privacy, security, and bias mitigation, and ensure its inclusivity and accessibility for all students.	When using ChatGPT, technical considerations play a critical role in promoting an authentic learning environment by ensuring that ChatGPT is reliable, accessible, secure, integrated, and personalised.

Human interaction	The use of ChatGPT should not replace human interaction but supplement and enhance it, so it is important to consider opportunities for students to interact with actual human experts or peers.	When using a chatbot, human interaction is important to provide emotional support, address misunderstandings, promote critical thinking, provide feedback, and support differentiation. By incorporating human interaction into a ChatGPT learning experience, teachers and instructors can create an engaging, supportive, and effective learning environment for all students.

Table 3 provides a comprehensive pedagogical framework designed to scaffold the effective integration of AI tools, such as ChatGPT, into higher education.

Conclusion

The conclusion on establishing constructive alignment between learning objectives and assessment when integrating AI chatbots encompasses three distinct dimensions: cognitive, pedagogical, and educational, as outlined in Table 3. Analysis and development of the pedagogical framework indicate that using ChatGPT promotes transparency and autonomy within an ethical framework. Transparency is a key feature, as ChatGPT provides explanations for its suggestions, alerting students to the necessity of a cautious approach when relying on identified sources. This empowers students with various informed options tailored to their preferences and needs. The autonomous experience is highlighted by ChatGPT's role in enhancing writing and research skills, offering guidance and feedback, and thus empowering students to remain focused on their learning goals. However, it is pivotal to note the importance of critical evaluation in assessing the reliability and credibility of sources suggested by ChatGPT, given its basis in machine learning algorithms and user input.

On pedagogical and educational levels, the utilisation of ChatGPT underscores the need for teaching strategies and methods that align with authentic learning and assessment environments. Regarding motivation and engagement, a pedagogical approach emphasising active learning and student-centred activities is beneficial in maintaining student engagement and motivation. Activities that foster student choice and autonomy, such as project-based learning or collaborative tasks, significantly enhance student engagement when using ChatGPT. By focusing on pedagogy that considers accessibility, motivation,

engagement, training, resources, and support, educators can leverage ChatGPT to foster a more inclusive and effective learning environment for all students. Chatbots offer tailored learning experiences by adapting to individual learning styles and preferences. They also provide support to students facing learning barriers, keeping them engaged with timely feedback, practice opportunities, and interactive learning environments. Chatbots play a crucial role in assisting learners to guide their individual educational progression.

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