

## *Using ChatGPT for Course Curriculum Design: A Systematic Review*

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The Paris Conference on Education 2024  
Official Conference Proceedings

### **Abstract**

Large Language Models (LLMs) based on artificial intelligence, specifically Generative Pre-Trained Transformers (GPTs), have experienced an upswing since the publication of ChatGPT in 2022. Numerous studies and stakeholders have already investigated the application of ChatGPT within the educational sector. However, the diversity of the settings studied, and the methods used have led to heterogeneous results and unstructured existing insights. Therefore, the objective of this paper is to examine and consolidate literature focusing on the use of ChatGPT for curriculum design. We searched two electronic databases, Clarivate's Web of Science and EBSCO, to screen for journal articles or reviews published until February 2024 using a pre-determined syntax. From the list of results, two independent reviewers selected relevant literature. In total, twenty-four articles were selected and reviewed in detail. Our findings indicate that ChatGPT is used for curriculum design in various educational fields. It supports educators in generating learning activities, content, and creating assessments. Using ChatGPT for curriculum design shows benefits, such as resource savings, but also challenges, such as the output quality, highlighting the crucial role of educators in output revision. Further research should focus on empirical determination of output quality and the comparison of different techniques to determine effective ways of using ChatGPT for curriculum design.

Keywords: ChatGPT, AIED, Curriculum Design, Course Design, Educational Technology

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## Introduction

The Chat Generative Pre-Trained Transformer (ChatGPT), released to the public by OpenAI on November 30th, 2022 (OpenAI, 2022), has emerged as a significant technological innovation. Since then, ChatGPT has proven remarkable capabilities in natural language understanding and generation, making it a versatile tool across various domains, including education. A recent study revealed that ChatGPT is widely used in various educational contexts, including higher education and K-12 education (Hadi Mogavi et al., 2024). For instance, ChatGPT may act as a tutor to support students with their homework by answering questions or providing explanations for complex concepts (Zhang & Tur, 2023). However, ethical concerns, privacy issues, and the risk of manipulation pose challenges for the use of ChatGPT in education (Tlili et al., 2023).

Apart from the use by learners, ChatGPT can also help educators to improve educational processes and thus improve the teaching quality, which impacts the learning success of students (Sagin et al., 2023). Educators can benefit from ChatGPT in many ways, such as brainstorming, generating course content and materials, or creating assessments (Sagin et al., 2023). Besides these use cases, it is conceivable that ChatGPT could potentially be used by educators to design course curricula. Curriculum design is a critical component of the educational process, including three main elements: planning content, determining the purpose, and organizing the learning. It influences the quality of education and the effectiveness of learning outcomes (Walker, 2003). Hence, a well-designed curriculum ensures that educational objectives are met, content is delivered in a coherent and logical manner, and students acquire the necessary knowledge and skills (Lattuca & Stark, 2009). Traditional curriculum design processes involve extensive research, collaboration among educators, and continuous refinement. Experienced educators are needed to develop curricula and interact with various stakeholders, which involves a great deal of time and effort (Walker, 2003). Despite these efforts, challenges such as the alignment of curriculum with industry needs, the incorporation of diverse perspectives, and the adaptability to changing educational paradigms persist (Lattuca & Stark, 2009). By leveraging ChatGPT, educators may be able to reduce the time and effort required for curriculum design and keep learning objectives up-to-date with current trends and best practices, thus better preparing students to meet the challenges of today's working environment. However, while most of the literature on the use of ChatGPT by educators focuses on content creation and assessment (Lo, 2023), its use and utility for the purposes of curriculum design is less researched.

This paper aims to address this gap by setting a specific focus and conducting a systematic review of the existing literature on the use of ChatGPT for course curriculum design, identifying its benefits, challenges, and potential future directions. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 (PRISMA 2020) framework (Page et al., 2021), we analyzed a variety of studies to examine the following research questions:

- RQ1: What are the current practices of using ChatGPT for curriculum design?
- RQ2: What are the benefits and challenges of using ChatGPT for curriculum design?
- RQ3: What are future directions and practical recommendations for educators and institutions considering the adoption of ChatGPT for curriculum design?

This paper attempts to offer a comprehensive examination of the existing research and practical applications to provide insights into how ChatGPT can be effectively used for

curriculum design. By identifying the benefits and challenges, the study provides valuable insights for educators and researchers.

## Methodology

The systematic review follows the guidelines of the PRISMA 2020 framework (Page et al., 2021). Based in this framework, we subdivided our procedure in three main steps. First, regarding our determined research questions, we identified the literature that must be included. After that, the identified literature was screened with respect to the fit of the content. Lastly, the selected literature was analyzed in detail and the findings were used to answer our research questions.

### Identification

To determine the syntax for the systematic review, a trial-and-error approach was used, which led to the most promising results. The determined syntax was *ChatGPT AND (course OR curriculum) AND (design\* OR develop\* OR plan\* OR creat\* OR craft\*)* and was used within the databases Clarivate’s Web of Science and EBSCO. The asterisk was used to include all the words containing those word components and thus broaden the search, making sure to not miss any potentially relevant literature. Inclusion criteria were defined to select relevant literature. The inclusion criteria consisted of formality-based and content-based criteria. On the formal side, only literature published in 2022 or later was included, since ChatGPT was published to the mainstream in 2022. Moreover, article types to be included were restricted to journal articles, papers, and reviews. Conference materials, editorials, commentaries, working papers, and white papers were excluded. We required the literature to be published or to be early access, which led to the exclusion of unpublished or pre-printed literature. Additionally, all literature not published in English was excluded from the review. Content-based decisions were made based on the title and abstract. To be included, the title or abstract had to be associated with curriculum design with ChatGPT. The selection criteria are summarized in *Table 1*.

Criterion	Inclusion	Exclusion
Topic in title or abstract	associated with curriculum design with ChatGPT	not associated with curriculum design with ChatGPT
Article type	journal articles, papers, reviews	conference materials, editorials, commentaries, working paper, white paper
Publication	published or early access	conference materials, editorials, commentaries, working paper, white paper
Language	English	not English

Table 1: Selection Criteria

Using the determined syntax and applying the selection criteria, the database Clarivate’s Web of Science returned 77 and the database EBSCO 192 results, which were transferred to an Excel sheet. From these results, 28 redundant articles and 21 non-English articles were excluded, resulting in a total of 220 formally qualified articles.

## Screening

To ensure an unbiased content-based selection, two independent reviewers screened the titles and abstracts of each article and assessed whether a particular article should be included or excluded from the review. The independent assessments of the reviewers were compared. In case of differing assessments, a third independent reviewer screened the title and abstract and submitted an additional assessment, leading to a surplus in favor of one of the previous assessments. By following this process, decisions could be made regarding the inclusion or exclusion of those articles. A more detailed screening of the main body of the remaining literature resulted in the exclusion of 18 articles. After the content-based selection, 24 articles were identified to be relevant and were reviewed in detail. This systematic approach is displayed in *Figure 1*.

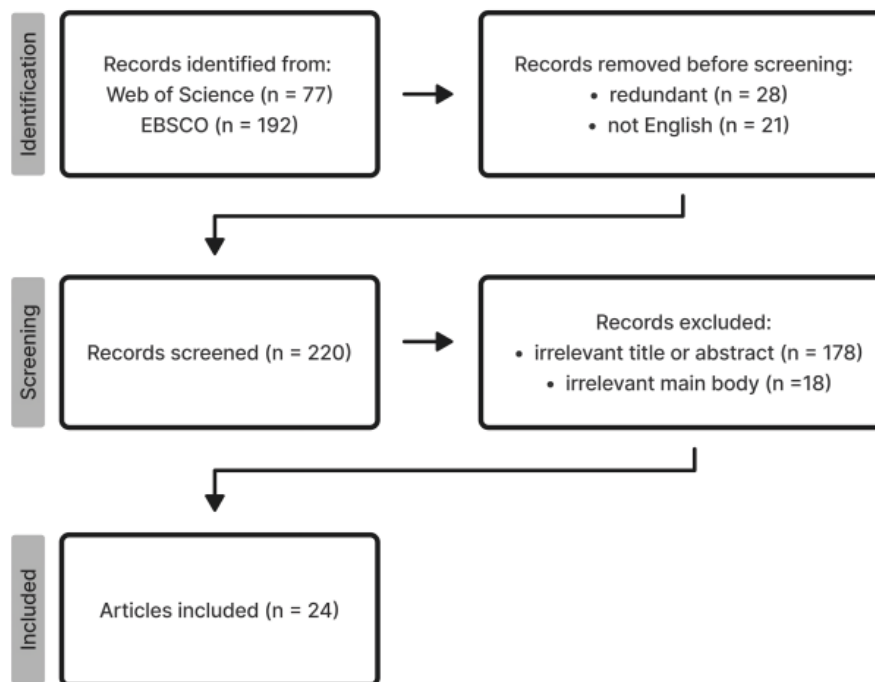


Figure 1: Systematic Approach for Identifying Relevant Literature

## Selected Literature Analysis

The included articles were collected in a separate Excel sheet and were reviewed by two independent reviewers with a focus on the used methodology and the key findings. After summarizing the content for the two categories, the findings from the two reviewers were compared to ensure that all relevant content was included and to avoid any ambiguities.

Within the eligible articles, we derived six topics with a deductive approach by coding the findings, identifying connections between the findings, and categorizing the findings accordingly. The final derived categories concern the types of research used within the literature, the educational sectors addressed by the articles, the benefits as well as the challenges when using ChatGPT for curriculum design, the recommendations for the use of ChatGPT for curriculum design, and the suggested further research directions identified by the present articles.

## Results

The findings of the systematic review are presented according to the six identified categories.

### *Types of Research*

Within the identified literature, various methods were used. Most authors conducted literature reviews, screening the opportunities of AI for education, and thereby addressing the ChatGPT use for curriculum design (Bahroun et al., 2023; Baskara & Mukarto, 2023; Castonguay et al., 2023; Demmar & Neff, 2023; Jin & Kim, 2023; Ratten & Jones, 2023; Sagin et al., 2023; Zhang & Tur, 2023; Kostikova et al., 2024; Leng, 2024; Shorey et al., 2024). Besides the reviews, many researchers adopted an exploratory approach, some of them incorporating either qualitative or quantitative analysis to assess their results (Bonner et al., 2023; Bozzetto & Lo, 2023; Han et al., 2023; Koutropoulos, 2023; Meron & Tekmen Araci, 2023; Pham et al., 2023; Smith et al., 2023; Al-Worafi et al., 2024; Bringula, 2024; Kostikova et al., 2024; Leng, 2024). For example, Davis and Lee (2024) generated a course outline through prompting and used interviews and journals for data collection, while Jin and Kim (2023) used the GPT-technology to dynamically generate and personalize content, subsequently evaluating its impact on the learning effect. Alipio et al. (2023) authored a perspective article in which the role of ChatGPT in health since education was explored. Purwasih and Sahnun (2023) focused on a slightly different context and thus solely relied on qualitative descriptive research methods such as observations, interviews, and focus groups to analyze the deviant actions by students and to derive recommendations for the use of ChatGPT in the educational context. Yang et al.'s study (2023) focused on ChatGPT's logical level. Hence, they conducted quantitative research by using various tests to assess its capabilities and to conclude on its usefulness for teacher tasks.

### *Educational Sectors*

We identified several educational sectors addressed by the literature. Seven articles were focusing on the medical sector (Alipio et al., 2023; Castonguay et al., 2023; Han et al., 2023; Smith et al., 2023; Al-Worafi et al., 2024; Leng, 2024; Shorey et al., 2024). Moreover, the pedagogical sector was considered within two articles (Apostolos, 2023; Davis & Lee 2024). Within the science sector the subsectors programming (Bozzetto & Lo, 2023; Jin & Kim, 2023; Bringula, 2024), finance (Bozzetto & Lo, 2023), and engineering (Pham et al., 2023) were identified. Other addressed sectors are the language sector (Kostikova et al., 2024), the design sector (Meron & Tekmen Araci, 2023), the management sector (Ratten & Jones, 2023), and the journalism sector (Demmar & Neff, 2023). The allocation of the reviewed literature is displayed in *Table 2*.

Sector	Literature
Medical	Alipio et al., 2023; Castonguay et al., 2023; Han et al., 2023; Smith et al., 2023; Al-Worafi et al., 2024; Leng, 2024; Shorey et al., 2024
Pedagogical	Apostolos, 2023; Davis & Lee 2024
Science	Bozzetto & Lo, 2023; Jin & Kim, 2023; Pham et al., 2023; Bringula, 2024
Others	Meron & Tekmen Araci, 2023; Demmar & Neff, 2023; Ratten & Jones, 2023; Kostikova et al., 2024

Table 2: Allocation of Educational Sectors

## ***Benefits***

Upon reviewing the literature, we found three primary benefits of using ChatGPT for curriculum design: support of the curriculum design process, personalization of learning, and reduced resource demands due to ChatGPT's support.

ChatGPT has the potential to aid educators in diverse aspects of curriculum design and acts as a competent partner for brainstorming (Meron & Tekmen Araci, 2023; Sagin et al., 2023). When starting to design curricula, learning objectives build the base for further steps. To identify and phrase these objectives, ChatGPT can support in drafting (Koutropoulos, 2023; Meron & Tekmen Araci, 2023; Sagin et al., 2023; Smith et al., 2023; Yang et al., 2023; Al-Worafi et al., 2024). Many authors highlighted the potential application for creating a lesson plan, course plan or curriculum in the format of a schedule or outline (Baskara & Mukarto, 2023; Bonner et al., 2023; Bozzetto & Lo, 2023; Castonguay et al., 2023; Han et al., 2023; Kostikova et al., 2024; Koutropoulos, 2023; Meron & Tekmen Araci, 2023; Purwasih & Sahnan, 2023; Ratten & Jones, 2023; Sagin et al., 2023; Yang et al., 2023; Zhang & Tur, 2023; Al-Worafi et al., 2024; Davis & Lee, 2024; Leng, 2024). Moreover, Koutropoulos (2023) prompted ChatGPT to produce a course policy and to determine prior skills and knowledge that are needed for a specific, previously created course. Next to those higher level outline activities, many authors addressed the potential support in the creation of concrete content or learning materials (Baskara & Mukarto, 2023; Castonguay et al., 2023; Han et al., 2023; Jin & Kim, 2023; Koutropoulos, 2023; Meron & Tekmen Araci, 2023; Sagin et al., 2023; Smith et al., 2023; Yang et al., 2023; Zhang & Tur, 2023; Bringula, 2024; Kostikova et al., 2024; Leng, 2024) as well as in the design of concrete learning activities (Koutropoulos, 2023; Sagin et al., 2023). Finally, the technology can be applied to create assessments (Alipio et al., 2023; Bonner et al., 2023; Bozzetto & Lo, 2023; Han et al., 2023; Sagin et al., 2023; Yang et al., 2023; Bringula, 2024; Kostikova et al., 2024; Leng, 2024). When specified, the considered use for assessment creation was mostly focused on the creation of assessment questions, e.g., Han et al. (2023) prompted ChatGPT to create questions for assessing the achievement of learning objectives.

Another capability of ChatGPT is to use it not only for generic generation but also for personalization purposes. It can be used for personalizing content (Alipio et al., 2023; Baskara & Mukarto, 2023; Jin & Kim, 2023; Sagin et al., 2023) and lesson plans (Baskara & Mukarto, 2023), it can offer personalized learning experiences (Bahroun et al., 2023; Ratten & Jones, 2023; Zhang & Tur, 2023; Leng, 2024) such as personalized instructions (Zhang & Tur, 2023) and feedback (Bonner et al., 2023; Zhang & Tur, 2023), explanations or learning paths (Alipio et al., 2023) and it can provide personalized information (Leng, 2024). Kostikova et al. (2024) critically reflected on the personalization aspect by mentioning that ChatGPT can be a tool to personalize learning, but it also runs the risk to offer less personalization by missing the capability to fully understand and adapt to the learner needs.

Based on ChatGPT's capability to support educators in various fields of the curriculum design process, resource savings were often mentioned and thus turn out to be a key benefit of ChatGPT use within the curriculum design process. Even though one article reported that using ChatGPT to create a course is not resource-efficient (Koutropoulos, 2023), in eight of the reviewed articles, reduced workload, hence reduced time commitment were elaborated as benefits (Bonner et al., 2023; Han et al., 2023; Meron & Tekmen Araci, 2023; Sagin et al., 2023; Zhang & Tur, 2023; Bringula, 2024; Davis & Lee, 2024; Kostikova et al., 2024).

Additionally, Jin and Kim (2023) pointed out that the use of ChatGPT for course content development paves the way for cost-effectiveness.

### ***Challenges***

The review revealed various challenges that educators are facing when using ChatGPT for curriculum design. These challenges refer to the quality of the generated output and the correct use of prompting techniques.

A previous review paper, which focused on the use of ChatGPT in school education (Zhang & Tur, 2023), reported that the most recurrently cited weaknesses are related to output quality issues. More specifically, we differentiated between issues related to *information quality*, i.e. the nature of the output, and *content quality*, i.e. the matter of the output. Challenges related to information quality included inaccurate or misleading information (Han et al., 2023; Koutropoulos, 2023; Smith et al., 2023; Zhang & Tur, 2023; Bringula, 2024; Davis & Lee, 2024; Kostikova et al., 2024; Leng, 2024), outdated or redundant information (Davis & Lee, 2024), biased information (Baskara & Mukarto, 2023; Smith et al., 2023; Leng, 2024), an inappropriate format of learning objectives (Koutropoulos, 2023), and missing differentiation between evidence-based and non-evidence-based sources (Shorey et al., 2024). Challenges related to content quality included incomplete syllabi (Al-Worafi et al., 2024), missing context (Baskara & Mukarto, 2023; Koutropoulos, 2023; Davis & Lee, 2024; Kostikova et al., 2024; Shorey et al., 2024), missing or unspecific learning objectives (Al-Worafi et al., 2024), a lack of transparency in content generation (Shorey et al., 2024), generic (Meron & Tekmen Araci, 2023) or pattern-like content (Bringula, 2024), a lack of alignment between curriculum components such as activities, assessments, objectives, and materials (Koutropoulos, 2023) as well as missing human nuance (Baskara & Mukarto, 2023; Kostikova et al., 2024). Moreover, Yang et al. (2023) emphasized that there are currently no evaluation criteria for the assessment of ChatGPT generated lesson plans.

The literature review suggested that the effective use of ChatGPT for curriculum design is considerably dependent on the user's experience and knowledge about prompting techniques. One of the challenges with prompting is that the same prompts may produce different outputs (Davis & Lee, 2024), which requires users to become more proficient in prompting to achieve the desired results. Moreover, it was found that ChatGPT demonstrates difficulties in handling certain types of questions, encounters issues with the recognition of accents and dialects, and lacks contextual understanding (Zhang & Tur, 2023). This requires additional effort for prompting, manually editing and restructuring the output (Meron & Tekmen Araci, 2023). Thus, creating learning units and course curricula using ChatGPT requires experienced human course developers (Meron & Tekmen Araci, 2023; Shorey et al., 2024).

### ***Recommendations***

Based on the benefits and challenges mentioned above, this chapter consolidates strategic recommendations for the effective use of ChatGPT in curriculum design. While ChatGPT can significantly reduce the workload of educators, it remains crucial to maintain a balance between AI-driven assistance and the expertise of human educators to optimize the outcomes. More specifically, this includes co-working with ChatGPT and reviewing the generated content to enhance the reliability and precision of the output (Alipio et al., 2023; Baskara & Mukarto, 2023; Castonguay et al., 2023; Han et al., 2023; Meron & Tekmen Araci, 2023; Bringula, 2024; Davis & Lee, 2024; Kostikova et al., 2024; Shorey et al., 2024).

Furthermore, educators need professional development regarding AI technologies so that they can meaningfully integrate such technologies as learning tools (Castonguay et al., 2023). Collaborative efforts and cross-verification techniques can improve the reliability of AI-generated content and ensure that educators are proficient in utilizing these tools to refine their teaching methods (Shorey et al., 2024).

Additionally, the literature review revealed a call for revisiting and updating existing educational practices to integrate AI technology into curriculum design. This includes the redesign of curricula, teaching methodologies, and assessment formats to enhance learning experiences and outcomes through more interactive and adaptive learning environments (Ratten & Jones, 2023). Here, curriculum design can benefit from taking pedagogical theories into account to ensure that AI integration aligns with ethical, regulatory, and professional considerations (Demmer & Neff, 2023).

### ***Further Research***

With respect to further research suggestions and possibilities, two articles generically suggested studying the new opportunities resulting from the use of AI for educational purposes (Bahroun et al., 2023; Leng, 2024). Furthermore, it was suggested to design an academic curriculum by collaborating with AI (Bahroun et al., 2023; Purwasih & Sahnan, 2023). To validate results originating from the collaboration with ChatGPT, further research should focus on deriving and establishing evaluation systems (Purwasih & Sahnan, 2023; Al-Worafi et al., 2024). Baskara and Mukarto (2023) recommended conducting further research to find out about limitations that ChatGPT faces in terms of processing more complex or abstract concepts. Moreover, the authors advised to conduct more research in higher education language learning context, specifically to investigate the relationship between ChatGPT and language learning and its potential to substitute human teachers. Smith et al. (2023) also focused on a specific educational area, encouraging further research on LLMs use in social psychiatry education.

### **Discussion**

This literature review has led to many new insights, which are discussed below in order to answer our questions of interest about current practices, benefits and challenges, and further directions and implications for the use of ChatGPT for curriculum design. In addition, we critically reflect on limitations of our research.

### ***Current Practices***

Our findings revealed that ChatGPT is used for curriculum design across a wide variety of subjects. This suggests that a key quality of ChatGPT may consist in the capacity to support educators in designing curricula independent of the subject area. These findings demonstrate the great potential of ChatGPT as a tool for facilitating and enriching the teaching process in diverse educational settings (Zhang & Tur, 2023).

While applicability may be broad, we found that the reviewed literature showed a considerable heterogeneity with respect to the methodologies used. More specifically, articles reported exploratory research including single case studies as well as quantitative and qualitative methods. This methodological heterogeneity suggests that since the release of



ChatGPT, standards and guidelines for using ChatGPT for education and for curriculum design have not yet established, representing a potential challenge for its use.

### ***Benefits and Challenges***

Our review showed that the integration of ChatGPT into curriculum design processes offers notable benefits for educators. It can support brainstorming and designing curricula aligned with learning objectives and learning needs. By providing alternative teaching and assessment strategies, ChatGPT may make the process of curriculum design more efficient and effective and may promote the creation of innovative and personalized curricula. By streamlining the initial stages of curriculum design, using ChatGPT saves time and effort for educators to refine and innovate their teaching methods and strategies (Koutropoulos, 2023; Meron & Tekmen Araci, 2023; Sagin et al., 2023). In the future, innovative curricula will be necessary to address and promote future skills of learners needed in a future digitalized working environment. At the same time, educators can leverage ChatGPT as a valuable resource to improve their digital competence, which is crucial for the effective integration of technology into teaching practices (Zhang & Tur, 2023).

Despite these benefits, several challenges persist in using ChatGPT for curriculum design. A primary concern is the quality of the generated output. Issues such as inaccurate or misleading information, outdated content, and lack of context can compromise the effectiveness of ChatGPT-generated materials and necessitates additional review and validation by educators (Koutropoulos, 2023; Zhang & Tur, 2023). Moreover, the quality and relevance of ChatGPT's output heavily rely on the user's ability to craft precise and effective prompts. While this could represent an initial barrier for using ChatGPT, inconsistent outputs from ChatGPT also enable a learning curve for educators in mastering these techniques.

### ***Future Directions and Practical Recommendations***

Since the absence of standardized guidelines may represent a barrier, future research should focus on the development of standardized guidelines and best practices for using ChatGPT for curriculum design. This includes ethical implications of using AI in education, such as data privacy and the potential for misuse. Moreover, establishing evaluation criteria for the quality and effectiveness of ChatGPT-generated materials will be crucial in ensuring consistent and reliable outcomes. Additionally, empirical studies comparing the efficacy of different prompting techniques and AI models will provide valuable insights into optimizing the use of ChatGPT for educational purposes. However, maintaining a balance between AI-driven support and human expertise is crucial. Educators should actively review and refine ChatGPT-generated content to ensure its accuracy, relevance, and alignment with educational objectives (Alipio et al., 2023; Castonguay et al., 2023). Training on effective prompting techniques and the integration of AI tools into teaching practices may empower educators to leverage ChatGPT more effectively (Shorey et al., 2024).

Moreover, exploring the integration of ChatGPT with other educational technologies could enhance its capabilities. For instance, combining ChatGPT with adaptive learning platforms or educational data analytics tools could provide more personalized and data-driven educational experiences and can also help address some of the challenges related to content quality (Castonguay et al., 2023).

## ***Limitations***

Our systematic review is subject to limitations. Regarding the methodological procedure, the objectivity of this review was ensured by the inclusion of three independent researchers for literature selection and evaluation. However, due to the nature of systematic reviews, subjective influences cannot be completely ruled out. Furthermore, due to a lack of clarity and filtering options, we decided not to use Google Scholar to search for articles. Although we used two other well-known and frequently used databases to compensate and opted for a highly comprehensive syntax, we may not have found all the relevant literature.

Moreover, the quality of the included papers varied. Within the identified literature, the topic was approached rather exploratively and often lacked empirical evidence. Additionally, the methods of some of the included studies were not described in detail, which leads to a lack of transparency and thus to the need for critical reflection. Therefore, the results of this review should not be taken as indisputable. Instead, they should serve as a foundation for further research in this area and should be carefully reflected and considered for practical application.

## **Conclusion**

This systematic review disclosed the relevance of ChatGPT for curriculum design by identifying 24 relevant articles in this field. We found evidence that ChatGPT may contribute to curriculum design in various ways and thereby saving time and effort. However, the output may be insufficient in terms of information or content quality and thus needs to be carefully reviewed and revised by experienced professionals. Our review demonstrated that ChatGPT has a huge potential to take on the role of a co-creator for designing curricula when used in a critically reflective manner. Further research is needed to empirically identify best practices and to determine effective ways of prompting to fully exploit the capabilities.

## **Acknowledgements**

This work was supported by the Bundesministerium für Wirtschaft und Klimaschutz within the project “MERLOT” which was funded under the project reference 68GX21008K.

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