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ARTIFICIAL INTELLIGENCE-ASSISTED LEARNING IN MOODLE

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Abstract. Generative Artificial Intelligence (AI) has unveiled numerous opportunities in education. All participants in the educational field have found benefits for themselves. Educators use it to prepare, organize, and conduct the educational process, including developing educational resources and exam materials, grading tests and assignments, preparing educational documentation, and more. Learners find its application useful for acquiring new knowledge, self-study, and completing coursework and homework, among other things. Administrative staff have discovered that AI can assist in preparing administrative documents, process and analyze data. The exploration of AI's potential in education is increasingly capturing the attention of researchers. This paper outlines several possibilities for integrating AI tools into the Moodle e-learning management system through external service APIs. It discusses the AI Connector, AI Text to Questions Generator, AI Text to Image, OpenAI Chat Block, and the benefits they offer to educators and learners. Practical examples of their usage and the results of an experiment with students are presented. Some risks and limitations of using AI in education are also discussed.

Keywords: artificial intelligence; education; innovations in education; Moodle

1. Introduction

Generative Artificial Intelligence (AI) has quickly found applications in various fields of science and practice, improving people's work efficiency and becoming an integral part of their daily lives. The development of technologies has posed a new challenge to educational institutions – to adapt and implement new technologies to increase the quality of the educational services provided. In recent years, there has been a steady trend of growing interest from the research community in applying AI tools in education (Kabudi et al. 2022).

There are numerous inspiring examples, shared good practices, and experiments showing how AI can transform education worldwide. Of interest are the possibilities of using AI in intelligent learning systems (Fitria 2021),

the use of robots for educational purposes (Ahmad et al. 2021), teaching evaluation and studying the learners' emotions (Chen et al. 2022), learning management and analyzing data to predict student status, identifying and delivering adaptive and personalized learning (Nguyen et al. 2023), using intelligent learning assistants and administrative services (Sankey & Marshall 2023), generating learning content (Zhang & Aslan 2021), translating learning materials, automated assessment (Tang et al. 2023), and virtual facilitation (Ahmad et al. 2021), among others.

Advances in AI can transform the educational landscape and positively impact all stakeholders. Undoubtedly, AI tools provide many opportunities for both educators and students. Institutions that invest in the development and implementation of innovative technologies will gain a significant advantage over their competitors. They can motivate learners more easily and increase their engagement in the learning process (Guan et al. 2020). Providing the opportunity to learn according to the individual pace and progress in the learning process (Kuleto et al. 2021) is a significant advantage. The possibility for learners to receive continuous feedback and real-time answers to questions tailored to their interests or knowledge levels is beneficial (Hemachandran et al. 2022). There is also a growing trend towards using chatbots and virtual assistants in coursework preparation. The implementation of AI tools enables the automation of system tasks such as student tracking (Nguyen et al. 2023), grading (Ahmad et al. 2021), conducting test examinations and assigning assignments and coursework, producing administrative reports and schedules (Fitria 2021), plagiarism detection (Gamage et al. 2022), and providing pre-programmed feedback, among others.

Teachers can use the accumulated data to adapt learning strategies to individual students and set assignments according to their abilities. Other opportunities to facilitate educators' work include identifying connections between learners' responses and desired conceptual understanding, organizing personalized learning, and supporting the engagement of learners with special educational needs (Chen et al. 2020). Automating these activities allows educators to focus on their work – imparting new knowledge to learners and performing tasks that cannot be handled by machines.

Despite the listed advantages, studies show that innovative AI technologies are often more difficult to adopt in an educational context. There is a need to conduct in-depth research on the algorithms used, as well as the application of AI in combination with educational theories in a physical classroom (Chen et al. 2020), in distance learning (Ouyang et al. 2022) and in training teachers to implement AI (Luckin et al. 2022). In addition, AI adoption in education also leads to increasing ethical risks and concerns regarding students' data and privacy. This requires educational institutions and teachers to follow moral principles during AI development and implementation.

As a result of increased interest in using AI tools in the learning process and the proven benefits for educators and students, learning management system (LMS) developers are looking for solutions to improve their systems. They develop various solutions by implementing AI tools (Aldahwan & Alsaeed 2020), e.g. virtual classrooms, virtual assistants, collaboration tools, plagiarism checking, multimedia broadcasting, electronic portfolios, voice interaction, peer review, brainstorming, and more. Implementing such tools allows vendors to turn their LMS into a comprehensive learning tool and stay competitive in the education technology market. The researchers expect that in the future, the traditional LMS will play the role of an intelligent mediator between deployed AI tools that will store and collate assessments, offer different learning scenarios, provide support to learners as needed, and more (Sankey & Marshall 2023). Learning platforms will allow educators to choose a set of tools that stimulate learners to develop hard-to-acquire cognitive skills such as creativity and critical thinking, which are necessary for working in increasingly automated economies and societies (Vincent-Lancrin & Van der Vlies 2020). Of interest to educators is the possibility of integrating AI-powered plugins and modules into the LMS they use (Kaleci 2025), (Yatim et al. 2025).

The article presents the results of an experiment on using AI tools in Moodle. Section 2 presents a systematic review of AI tools that can be integrated into Moodle. Section 3 presents practical examples of the use of integrated tools within a real educational process.

2. Integrating AI tools into Moodle

Moodle is one of the most widely used open-source learning management systems. It supports a variety of functionalities that make it easier for teachers to organise and conduct the learning process and stimulate better performance, engagement and satisfaction among students. Different factors, such as open-source, widespread use, and a large developer community, drive the development of multiple AI tools for integration into Moodle (Manhiça et al. 2022).

The experiment presented in this article was conducted in Moodle, installed at https://edu-services.eu. The following tools have been integrated for this research: AI Connector, AI Text-to-Questions Generator, AI Text-to-Image, and OpenAI Chat Block.

The **AI Connector** provides the ability to integrate Moodle with *external AI services* based on APIs (Dziminski 2023). It allows the use of a test page and API requests to test connections to AI tools. The AI Connector does not provide end-user functionality.

AI Text-to-Image can *generate images from text* for configuring learning activities and resources (Klein 2023). Using an OpenAI API connection, the tool adds AI-generated images to the Moodle file picker (see fig. 1) that can be used by teachers and students. Teachers can use it to find a more context-specific image for a course. Fig. 2 presents generated images for the Database course.

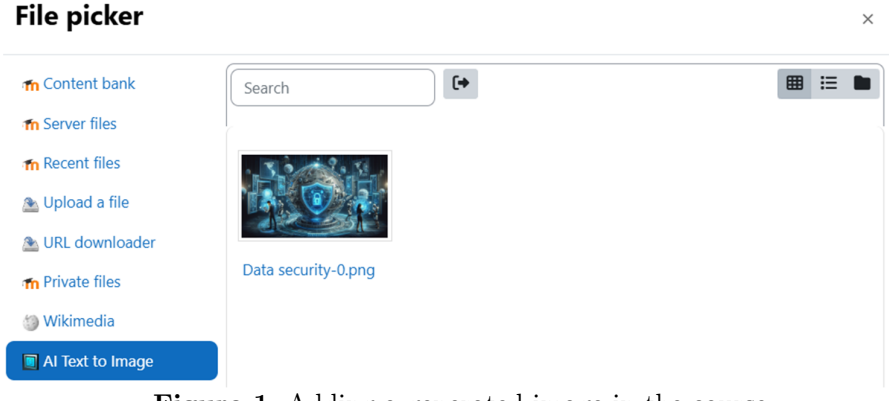


Figure 1. Adding a generated image in the course

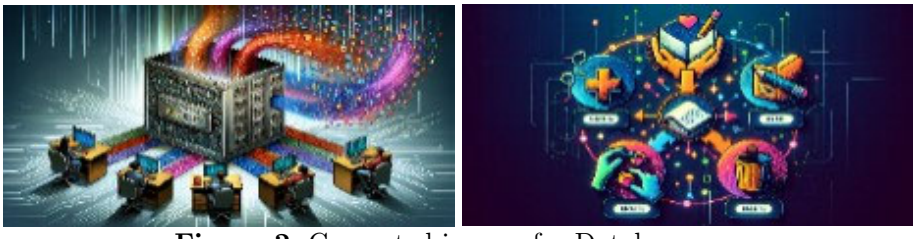


Figure 2. Generated images for Database course

The **AI Text-to-questions generator** tool automates the process of composing tests and other assignments by sending requests to ChatGPT to generate questions. It can *generate tests* of varying difficulty levels according to student performance (Klein & Salomon 2023). The tool can create questions based on learning content uploaded by a teacher or on a given topic (see fig. 3). In the second case, it uses its knowledge base to construct questions. The tool saves the questions in the Moodle course question bank. Teachers can edit saved questions and add them to specific tests. When building questions based on learner performance, the teacher can instruct the generator to transform the questions to suit students with learning difficulties or students who more easily cope with the learning material. For questions with a lower level of complexity, some answers are more basic and easy to rule out. For questions with a higher level of complexity, some automatically generated answers are close in meaning, making it more difficult to determine the correct one.

The **OpenAI Chat Block** virtual assistant is an *AI chatbot* that provides 24/7 support for students to encourage active learning and independent research (Yoder 2024). It helps students search for information, clarify their questions, and explore topics related to course learning content. The assistant does not know the course structure or the contents of the files. It remembers the context of the conversation and can relate each question to the previous ones in the communication. However, when the user reloads the page, the current communication is lost.

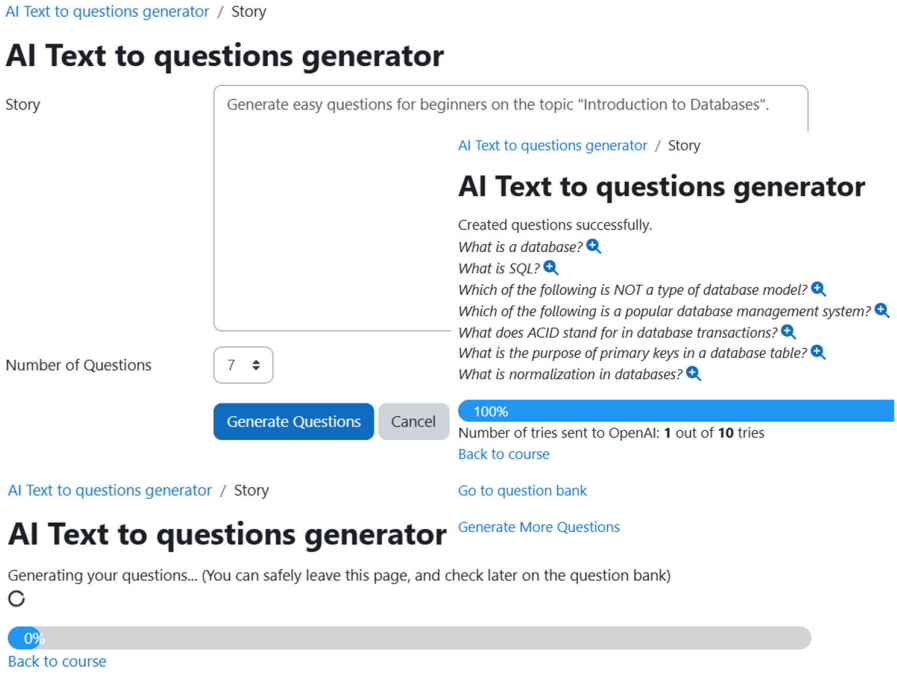


Figure 3. Generating questions with AI Text to questions generator

The intelligent chatbot has applications for many other activities – administering Moodle, helping users navigate the site, and more. Fig. 4 shows an example of a tip in response to the question: "How do I change the time zone for each user as an administrator?". The response contains specific steps for the administrator to follow and warnings that any user can also change the time zone from their profile despite the default settings the administrator has set. The virtual assistant is added as a block in Moodle.

For the operation of the presented tools, a key to the OpenAI programming interface is required (OpenAI API keys). The service is with payment on a per-use basis measured in tokens per minute (TPM) and requests per minute (RPM) and model used (e.g. GPT-4, DALL-E).

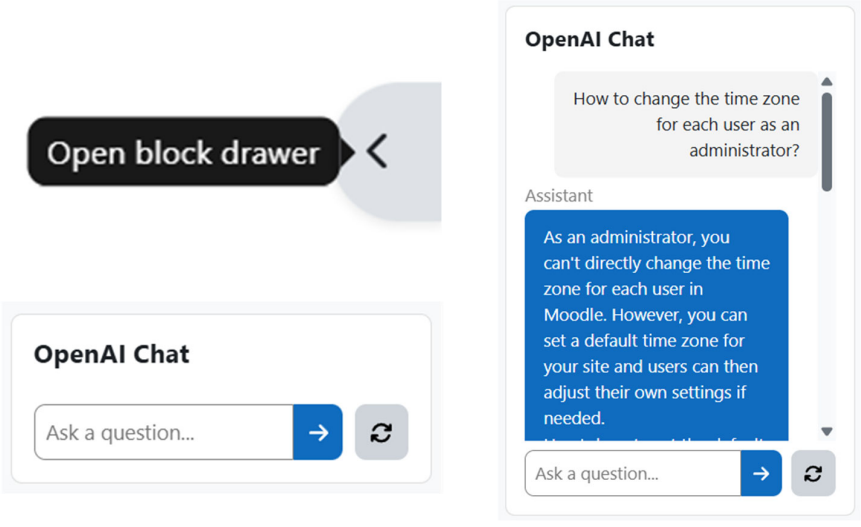


Figure 4. Using OpenAI Chat Block for administrative tasks

Other modules can be integrated into Moodle to deal with problems of academic ethics and dishonesty, such as attempts at exam cheating (proctoring), plagiarism (Urkund, Turnitin, Plagiarism and SafeAssign), among others.

3. Experiment

The presented tools were tested in the learning process during the summer semester of the academic year 2023/2024 in the Faculty of Mathematics and Informatics at the University of Plovdiv "Paisii Hilendarski". The trainees were 3rd-year students from four study programs – "Mathematics"; "Applied Mathematics"; "Information Technologies, Mathematics and Educational management"; "Mathematics, Informatics and Information Technologies".

Teachers invited the students to participate in the experiment voluntarily and 13 students agreed. Teachers gave five assignments for completion with the help of AI during extracurricular time. Students were to explore what "views" are in the context of relational databases. To solve the assignments, they used a database developed by them, used during the exercises and well known to them.

In the **first assignment**, students had to use the JOIN operator studied in the Databases course to create two SQL queries against the database. This task prepared students for Task 4, where they had to format these two queries as views.

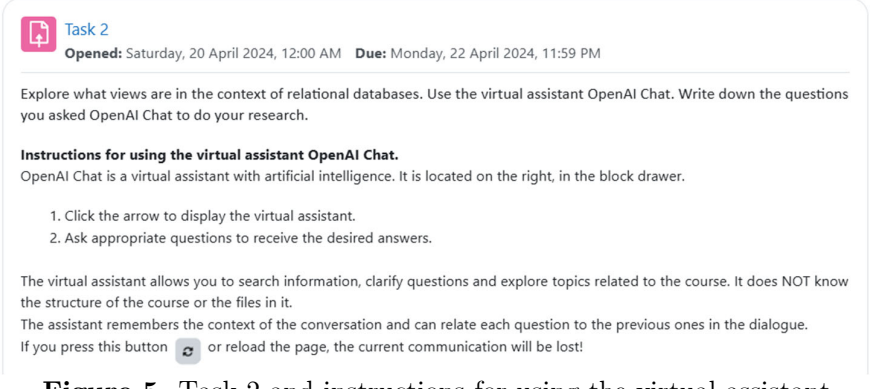


Figure 5. Task 2 and instructions for using the virtual assistant

In the **second assignment**, students had to explore what views are using the virtual assistant in Moodle. Teachers gave them detailed instructions for using the virtual assistant (see fig. 5). To track students' communication with the virtual assistant, teachers asked the students to upload the questions they asked the assistant to Moodle (see fig. 6).

To check how much the students understood the essence of views, teachers asked them, in a **third assignment,** to answer five multiple-choice questions: "What is a view in a relational database?", "What role does the view play about the tables in the database?", "What is the main function of views in relational databases?", "What capability do views provide to users?" and "What happens to the view if the structure of the tables from which it derives data

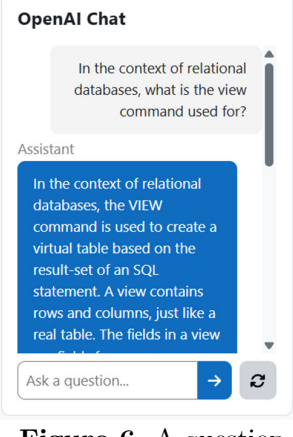


Figure 6. A question asked by a student

changes?" (see fig. 7). Teachers created the test questions and possible answers using AI Text-to-questions generator.

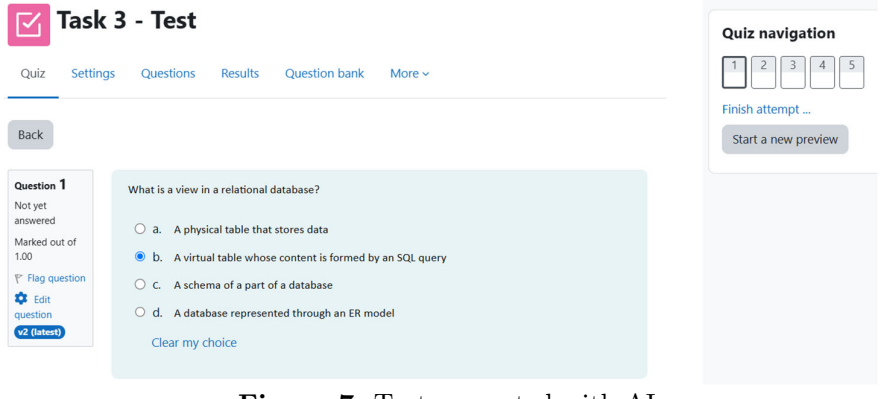


Figure 7. Test generated with AI

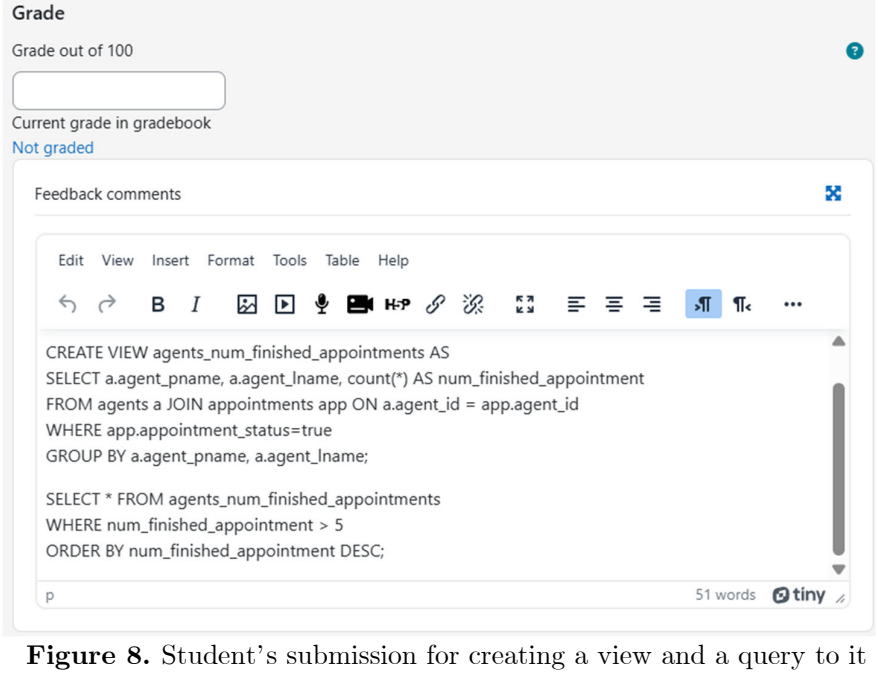


Figure 8. Student's submission for creating a view and a query to it

In the **fourth assignment**, students had to demonstrate new skills – create a view and write a query for this view (see fig. 8). To do this, again with the help of the virtual assistant, they had to study the syntax for creating views in the SQL language. This assignment is directly related to the first assignment. Here, students had to use the code of the two queries they wrote in the first assignment to create a view and formulate a query.

The **fifth assignment** required students to write their opinions about the advantages and disadvantages of using views (see fig. 9) without using the virtual assistant.

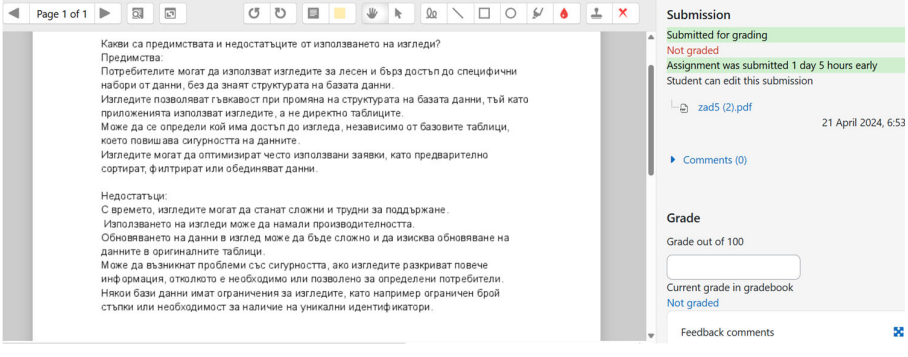


Figure 9. Student's submission for the assignment for determining the advantages and disadvantages of using views

The assignments set in this way required the students to demonstrate higher-order thinking skills. Students were to explore the concept of views in relational databases and ***analyze*** how they function. The assignment for creating and querying a view required ***synthesis*** skills – combining information and structuring it in such a way as to develop an appropriate solution. In addition, they had to ***assess*** their solutions – find out if the code they wrote worked correctly and, if necessary, debug it. They had to demonstrate an understanding of how views can optimize their work and when it is most appropriate to use them.

Students could not use the virtual assistant for the fourth assignment because the task was addressed to a specific database. Assigning a suitable context to the virtual assistant is difficult and requires preparation.

The students were excited to use AI to complete the tasks. The results of the experiment showed the following:

– 9 students worked on the **1st assignment** – 7 successfully coped and showed stable knowledge of the material studied during the semester.

– 11 students who worked on the **2nd assignment** using the instructions asked the virtual assistant questions about views: 2 students asked the virtual assistant to answer only one question, 1 – two questions, 1 – three questions, 1 – four questions, and 6 students asked six or more questions. One of the students preferred to ask his questions in English.

– All 13 students completed the test of the **3rd assignment**: 6 students answered all five questions correctly, 4 students – four questions, 1 student – three questions, and 2 students – two questions.

– 8 students worked on the **4th assignment**: 4 have successfully created views as 3 of these students also wrote correct queries to the view, and 4 students did not cope with this task.

– 11 students worked on the **5th assignment** and gave correct answers. It could be seen that 4 students used the virtual assistant, even though the task explicitly required them not to use it, 4 gave their own answers, and for 3 students it was not possible to determine whether they used the intelligent assistant when completing this task.

4. Conclusion

Undoubtedly, the future development of education will be closely related to the development of AI. The results of the conducted experiment once again demonstrate the benefits for teachers and students.

The conducted study has some limitations. Due to time restrictions, only a few students participated. In the next academic year, we plan to enrich Moodle with intelligent tools to prevent cheating attempts during tests, conduct an experiment with more assignments and involve more students in the process. At the end of the experiment, we plan to study student satisfaction with using AI tools in the learning process and compare students'

final grades with the results from the previous year when students didn't use official AI tools.

Despite the benefits, AI also poses certain risks. On the one hand, AI can generate incorrect or misleading learning content that students may accept as correct answers without analysis or critical evaluation. On the other hand, students may become too dependent on AI and fail to develop critical thinking and problem-solving skills. Thus, AI can reduce their ability to learn and work independently. Other risks relate to the potential **misuse** of technology to commit academic fraud, e.g., copying answers from ChatGPT for homework or exams, and to the privacy and security of student data. These risks present educational institutions with the challenge of implementing specialized tools to protect personal data and ensure information security.

In addition, the human factor is essential to the educational process, and AI cannot completely replace teachers. It can assist them in routine activities such as developing learning materials, grading tests, and providing personalized learning resources. However, AI cannot provide students with emotional support, motivation or personal attention. The intelligent use of AI in education can significantly facilitate and optimize the learning process for teachers and students. However, to achieve this, it is necessary to introduce clear and effective regulations for using AI in education and strict rules for intellectual property protection.

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NOTES

1. OpenAI API keys, 2024. https://platform.openai.com/api-keys

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