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*Article*

# Artificial Intelligence and Educational Efficiency: *An Analytical and Critical Approach to the Challenges and Prospects of Integrating Artificial Intelligence in Education*

Dr. Kerouaz Douadi
Mohamed Lamine Debaghine University, Setif 2, Setif, Algeria
Email: d.kerouaz@univ-setif2.dz

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Abstract

I am not exaggerating when I say that we are currently living in an era where machines intervene and perhaps dominate various aspects of life. Does this not compel us to adhere to the necessity and priority of utilizing and employing artificial intelligence within educational institutions, curricula, and even at the administrative level of educational structures? Are we not in dire need of providing tools and methods that can support education, teachers, and learners alike? Or at least assist in assessing learning and teaching, achieving other educational goals, and facilitating tasks such as supporting educational administration, offering learning opportunities for all, and developing skills necessary for success in life and work? This would benefit various stakeholders, including institutions, students, teachers, administrators, and even parents, making the process of teaching and learning more flexible and transparent for everyone, which is the ultimate goal of education. In this research paper, I strive to present some justifications for this approach by addressing the issue of balancing the benefits expected from the proper or improper use of artificial intelligence in education, as well as outlining the various roles this automated model


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will play in enhancing forms of education, naturally in line with the different crises, places, peoples, cultures, and peculiarities.

Keywords: Artificial Intelligence, Educational Efficiency, Prospects, Challenges of Smart Education

Introduction:

Humanity today recognizes a significant development in the fields of knowledge and information technology, where the latter has become the fundamental pillar that cannot be overlooked in all areas of daily life. This has led to the classification of developed countries based on their ability to exploit this technology and the information they possess, as well as how they organize and employ this information to serve humanity. Therefore, the use of information and communication technology has been one of the important issues that have been praised, serving as a decisive indicator of the development and advancement of educational institutions and the bodies operating within them. Before introducing these technologies to encompass all elements of the educational process, especially from the perspective of providing satisfaction to all concerned parties in an educational environment seeking development, improvement, and the advancement of its educational systems, new educational terms have emerged. Among these is what is known as smart education or learning with artificial intelligence, which is one of the most significant innovations that have penetrated our current era, forming a valuable addition to computers and playing important and significant roles that did not exist before.

Consequently, the use of artificial intelligence techniques has become one of the priorities that impose themselves to support the process of teaching and learning and achieve its quality, as these techniques assist both learners and teachers significantly in various fields. They can analyze vast amounts of data and information to reach successful and sound decisions. Despite being a branch of computer science, artificial intelligence has become capable of simulating human behavior and thinking in the same way that brains and minds operate. It has contributed to enabling humans to use human language in dealing with machines. Therefore, it is imperative to emphasize that artificial intelligence, in its current form, has become more than a necessity, as it refers to a set of diverse applications in scientific, theoretical, and especially educational fields. One of its most important applications is in education, aiming to elevate and enhance the teaching and learning process to the highest levels of effectiveness and flexibility, especially in supporting learners in self-learning and assisting in bridging gaps and deficiencies that most teachers cannot address. Thus, it provides students with greater freedom to perform their educational tasks, clarifies areas of weakness, addresses them, and offers continuous and immediate support, contributing to achieving high-quality education that enhances self-learning and develops learners' technical skills.

Based on this, we say: If artificial intelligence, in its initial and commonly understood concept, refers to those automated programs designed to simulate human intelligence, which originally rely

on data provided by the human mind and are then trained as self-learning programs to continuously collect as much data as possible in what is known as integrating intelligence with products, we do not wish to elaborate on definitions here, as its general concept has become familiar in contemporary language. Instead, we aim to focus on a philosophical question or rather a philosophical perspective on the limits and dimensions of the presence of artificial intelligence in the field of didactics, considering it has become more than a necessity in many areas, particularly in the sciences that have become associated with their development with the extent of its presence in the results they provide. Given that education is the gateway and fundamental ground for all sciences, we are compelled to question the nature of returning to artificial intelligence in our educational systems according to the logic of prioritization. In other words, are we obligated to keep pace with the era and thus resort to listening to the dictates of artificial intelligence cognitively, ethically, pedagogically, and educationally, with all its pros and cons? Or are we free to deal with it, resorting to it sometimes with caution and abandoning it at other times?

1. Educational and Procedural Understanding of Artificial Intelligence:

Through our repeated readings of the perceptions and propositions of some contemporary educators regarding the concept of artificial intelligence in education, we have arrived at an epistemological understanding of artificial intelligence that views it as a set of ideas and efforts aimed at developing and improving computerized information systems in a manner that aligns with human behaviors and assists them in various life tasks and accomplishments. This makes it known, in terms of its applications in education, as the possible uses of artificial intelligence in education, which involves using digital educational programs capable of performing numerous tasks that simulate human behavior. These programs can engage in learning, thinking, teaching, and guidance, granting humans the ability to make decisions in an organized scientific manner. Therefore, procedurally, it expresses success in employing artificial intelligence programs, techniques, and smart tools to assist learners in facing difficulties encountered within the classroom and educational environment, such as reading, writing, and research. This includes various computational applications that help them solve problems easily and effortlessly.

With this understanding, we believe that artificial intelligence as a science dates back to the beginnings of human use of machines. Its use developed when humans, driven by imagination, sought to create an extraordinary machine capable of simulating their thinking and performing tasks that only humans could do. In the 1950s, the first attempts were made to develop automated models capable of exhibiting simple behaviors such as learning. However, those models failed and could not exhibit any complex behavior. These models relied on neural networks, indicating that the concept of artificial intelligence during this period referred to simulating the human mind by developing programs that mimic the functioning of neural networks in the human brain. The term "artificial intelligence" was coined in 1956 by John McCarthy, who in 1958 also invented the programming language LISP, related to artificial intelligence.

It also refers to the ability to understand emergency situations or new and changing conditions, meaning to perceive, comprehend, and learn unfamiliar situations or conditions. Thus, intelligence is represented in perception, understanding, and learning. As for the second word, "artificial," in the language, it is related to the verb "to make" or "to manufacture," and the word applies to all things that arise as a result of activity or action involving creation and formation, distinguishing them from things that naturally exist without human intervention. The concept of artificial intelligence also refers to: the method through which the capabilities of human intelligence are simulated. It is a branch of computer science that deals with the design of intelligent systems that exhibit a set of characteristics associated with intelligence, related to many human behaviors.

Some Arab educators have defined it as one of the modern computer sciences that seeks advanced methods for performing tasks and drawing conclusions that are similar, even to a limited extent, to those attributed to human intelligence. Thus, it is a science that explores how computers can simulate human intelligence and the expertise of specialists in all fields. It focuses on developing programs to solve problems by processing data and information in non-algorithmic ways. Therefore, it is the science that explores how to make computers perform tasks that humans do in a better way. It is a branch of computer science concerned with understanding and applying technology that simulates human intelligence traits, and thus controls a branch of computer science that simulates human intelligence, skills, or expertise by developing programs and devices that can perform operations similar to such intelligence, skills, or expertise. Accordingly, artificial intelligence is the modeling and simulation of human behavior..

Its use in educational policies came through the use of electronic computer systems in processes that involve human-like interaction, such as educational programs designed in the form of dialogue, where the computer plays the role of the expert teacher who knows the correct answer and the smart decision, and rejects the user's wrong answers correctly based on error analysis and categorization.

Therefore, scholars and researchers in artificial intelligence have differed in their definitions of this science. This divergence indicates that our concept of what constitutes intelligence in general is still vague. Despite the differences in defining artificial intelligence, most experts, according to our understanding, agree that its concept is limited to being one of the fields of study concerned with designing and programming computers to carry out tasks and functions that usually require human intelligence. Therefore, we ask: To what extent has it become necessary to return to these intelligent applications to carry out tasks essential for daily life? And how important is this usage for achieving educational effectiveness?

2. The Importance of Artificial Intelligence in Education:

We believe that the current era is truly an era of machine dominance par excellence. Accordingly, artificial intelligence has gained paramount importance in the field of education,

especially in what is referred to as the era of technological renaissance and automated control. This importance can be summarized as follows:

No one can deny the practical benefits provided by artificial intelligence systems in education. They help reduce administrative burdens, make correct administrative decisions, and distribute work and tasks impartially according to teachers' decisions and orientations. They also help the teacher break free from rote teaching methods or reliance on a single teaching method. In addition, they support self-development, as they store information effectively and then retrieve it at the right time easily and efficiently, saving effort and allowing focus on sensory education to meet learning process requirements.

Artificial intelligence has also become the nerve center of daily life, and it is indispensable amid the massive scientific and technological development that has permeated all fields. Humanity has come to depend on artificial intelligence systems in various aspects of life, and one of the most important fields that has become dependent on these smart systems is the education system. These systems facilitate communication and cultural exchange between different dialects and on all levels.

Artificial intelligence is also used in education to meet needs that cannot be addressed through traditional and simple educational methods. It provides an advanced and constantly evolving educational system that is open to the digital and logarithmic virtual world. In a technologically controlled world, it enables the learner to access intelligent automated learning through the presentation of content in the form of multimedia auditory and visual stimuli—written, audible, or even animated.

Artificial intelligence is also useful in designing smart teaching systems for subjects in which some learners may have great difficulty comprehending or learning due to their complex and abstract nature, or because experiments cannot be conducted on them in laboratories due to their danger and impact on humans, such as nuclear reactions.

Artificial intelligence systems are also considered powerful knowledge sources for improving the teaching and learning process, as they are capable of providing a well-prepared and fully trained virtual teacher with human-like characteristics. This teacher can interact with learners during learning at any time and in any place. These systems also contribute to facilitating decision-making and saving the time needed for discussion and critique of many issues that are difficult to understand and grasp.

From the above, it becomes clear that interest in artificial intelligence has become a modern necessity, in order to keep up with the times and its changes, as the present era is called the era of technological renaissance and the information revolution. Hence, paying attention to it and activating it in various sectors has become inevitable. Its use in various fields, especially in education, contributes to reducing human effort and anxiety, alleviating pressures through time management, and helping carry out many tasks that are difficult or impossible for humans to perform. In addition, the study of artificial intelligence and its applications, and the move toward

producing smart devices, has become a sign of progress and development. Therefore, it is necessary to pay attention to studying it, learning its concepts and secrets, and realizing its importance—especially in terms of representing and expressing knowledge. AI systems possess a large base of knowledge that enables them to link cases and results. These systems also have the ability to separate this knowledge base from the processing systems that use, analyze, and interpret this knowledge. Thus, knowledge representation depends on a base of extensive data, information, details, and facts, and also depends on processing systems and how to deal with and make the most of the data and information.

Artificial intelligence also grants us the ability to learn by relying on machine learning strategies, through which data is analyzed and sufficient, comprehensive information is provided, while excluding irrelevant data, classifying information, and benefiting from it. It also stores necessary information for later use in new situations. Moreover, conflicting or uncertain data indicates the nature of artificial intelligence systems capable of dealing with all data—even if that data is contradictory, ambiguous, or incomplete—thus providing appropriate solutions. Smart computers also have the ability to solve problems and suggest possible solutions, even in the absence of all the necessary data and information to make the required decisions. This is known as generative intelligence, which can design educational materials to contribute to personalized learning based on knowledge of learners' data.

Artificial intelligence also works to find a mechanism for problem-solving by relying on objective judgment and accurate estimation of solutions, while raising the cognitive level of organization leaders and officials, as it provides many quick solutions to problems that are difficult to solve through human input. Therefore, it is characterized by consistency and relative control as it is not subject to the factors of forgetfulness and the consequences that come with storing information and using it in later situations.

3 - Advantages of Education Based on Artificial Intelligence Applications:

Many contemporary research results and studies have proven the necessity of employing artificial intelligence in education, as it is the first and fundamental tool that helps achieve various learning outcomes, especially rapid academic achievement, thinking skills, and solving complex physical problems. It also helps provide skills that support making correct and decisive decisions that align with circumstances, stimulates critical thinking, and develops classroom management skills through electronic platforms. Therefore, AI in education is considered one of the best tools that speeds up teaching tasks, allowing the process to flow automatically. It can also identify topics that need more attention during classroom learning and guide and support students outside of educational institutions through what is now known as distance learning. Consequently, it facilitates the use of data collected through learning, which makes students more daring in making decisions that support their educational success freely.

These practical advantages can be summarized in the following points:

- In our view, no one now denies the service that artificial intelligence provides in making it easier to understand and apply scientific theories and practical rules and laws, in addition to improving the quality of using them better and faster. This contributes to giving the learner enough time to absorb and apply scientific content.
- It also contributes to allowing a large degree of active participation that captures learners' attention, provides them with adequate, clear, and accurate information, and increases their motivation to learn.
- It also helps train learners in using information and practicing skills, making learning significantly impactful and lasting.
- In addition to its important and effective role in solving orientation and guidance problems for learners, it provides systems with tested and proven experience in the field of advising and guidance for students individually and immediately.
- It also offers a great degree of interactivity in learning environments, answering most of the learners' questions and recurring issues countless times, and helps them find diverse possible solutions.

Artificial intelligence is characterized by multiple features and unique properties that cannot be fully counted. However, they can be summarized in philosophical terms as solving most problems that are difficult for the human mind—even in the absence of data. Thus, it is capable of thinking, perceiving, acquiring knowledge, and applying it in various fields and topics under all conditions, with the ability to respond quickly to new and emergency situations. It also excels in speed and accuracy when dealing with difficult and ambiguous conditions and variables.

Therefore, we believe that given the dominance artificial intelligence currently holds compared to human intelligence, it now operates using a comparative method to the human approach in solving complex problems and beyond. It has moved to handling hypotheses simultaneously with great speed and accuracy. Consequently, it proposes specialized solutions for each problem and each homogeneous group of problems. It operates at a consistent scientific and consultative level without fluctuation, especially since it relies on representing vast quantities of knowledge in a particular field. It processes symbolic, non-numerical data through logical analysis, comparison, and inference—one of the logical deduction processes that used to be exclusive to philosophical reasoning. That includes the use of rules, facts, different research methods, and intuition to reach a particular conclusion. Artificial intelligence is now capable of inference through image and sound matching, among others, and also relies on building a knowledge base that grants computers the ability to infer and reach logical conclusions, and make judgments more quickly and accurately.

4 - Some of the Most Important Applications of Artificial Intelligence in the Field of Education and Their Challenges:

Despite the limited availability of philosophical and even scientific research in the field of artificial intelligence—due to the modernity of the topic, which has led to very limited use in some areas even in developed countries, as UNESCO noted in 2021—this stems from skepticism about its ability and applications to make a fundamental difference in education, especially value-based education. This aligns with the lack of philosophical and scientific cumulative research and the procedural challenge of repeating such studies. In particular, it raises doubts about the effectiveness of AI technology and its applications in the educational field. In addition, the supposed effectiveness of artificial intelligence, according to some scientists, may be due to the novelty of its technologies and applications rather than their intellectual, scientific, or ethical substance.

Accordingly, scientists—and most people—have been divided into two groups in anticipating what will happen to humanity after reaching technological singularity. Will artificial intelligence control their minds, and therefore their private and public lives—having already begun to take over jobs and individual behaviors, and perhaps institutions and states? Or will it cooperate with us in making our lives better? I am not referring here to the anxious and cautious category, which includes most people, and perhaps us in the Third World, but to the second group, which is optimistic about a better future for humanity with this development. Therefore, a philosophical debate has recently emerged about the future of humanity in light of the rise of artificial intelligence and its explosive growth, especially after the emergence of the first signs of the quantum computer, whose speed exceeds that of the current computer by billions of times.

Below we will present some practical models of artificial intelligence in education that are still in practice and application in some countries and have not yet been generalized to most educational institutions, except in countries with expertise in using artificial intelligence systems, software, and educational applications, including:

1.4. Smart Tutoring: which means employing artificial intelligence methods to simulate human private tutoring and provide educational activities that better match the cognitive needs and learning levels of the learner, ensuring that all learners receive appropriate and targeted feedback, all without the presence of a teacher.

Artificial intelligence can provide grammatical instruction and personalized education for students through methods embedded in intelligent tutoring systems. This is achieved through the use of three key components: the user model, which represents the student's profile; the interaction model, which acts as the mediator between the user and the application; and the domain model, which includes necessary and essential types and models of instruction.

2.4 Adaptive Learning Environments: All AI applications in education aim to provide a learning environment that meets most of the learners' needs and preferences. These systems allow learning to occur according to the students' desires and learning styles. This means that employing AI allows for a form of learning based on plans that align with each learner's characteristics and capabilities, regardless of the surrounding circumstances.

3.4 Use of AI for Assessment Purposes (Embedded Assessment AI-supported): AI applications in learner assessment include grading homework, performance tests, and various other tasks. Many uses of AI can be employed in the field of educational assessment.

Despite the effectiveness of these applications in achieving certain educational goals—and perhaps their acceptance for the pedagogical services they offer, especially when human supervision is insufficient—they cannot replace the need for activating students' real abilities, skills, and personal experiences. These are aspects that cannot rely solely on pre-packaged content, in accordance with the biological rule that says unused organs eventually atrophy. Based on this, the "Institute for the Future of Humanity" was recently established at Oxford University by Swedish philosopher Nick Bostrom, one of the most prominent advocates for caution regarding the superiority of artificial intelligence over human intelligence and the approach of technological singularity.

Bostrom illustrated this concern in the introduction to his 2014 book with the parable of the sparrows and the owls, in which a group of sparrows decides to enlist the help of wild owls to assist in nest-building and difficult tasks. A few sparrows warned the rest about losing control over the owls, which ultimately happened. In Bostrom's analogy, the owl represents artificial intelligence, and the sparrows represent humanity.

Thus, I argue that blindly embracing artificial intelligence as the primary educational foundation—without regard for human, ethical, or moral particularities—leads us into a mechanical state where values die, identities disappear, and essences are distorted. This removes any meaningful standard for benefit and harm. The value of artificial intelligence has been put in question again, especially after a large group of its own supporters—including Stephen Hawking, Noam Chomsky, Bostrom, Jaan Tallinn, Demis Hassabis, Shan Ling, and others—signed a 12-page open letter in 2015. The letter called on the governments of major world powers to conduct studies to assess the societal impacts of AI, and invited global citizens to participate in drafting preemptive laws to regulate and prevent unethical uses of this technology. A Critical View of AI Applications in Education: According to our understanding and research, artificial intelligence technologies—through their systems and mechanisms—aim to produce computer software that simulates and emulates intelligent behavior, with the goal of surpassing human intelligence. Theoretically and scientifically, this goal is commendable. The study of AI depends on understanding contemporary scientific foundations such as knowledge representation, reasoning, control, and problem analysis and decomposition.Some scholars define AI tools as programs that provide learners with samples, tools, and assistance during the learning process until they reach the stage of knowledge control and mastery. These systems are capable of delivering experiences through unlimited practice on problems in a systematic and organized manner. They work to uncover learners’ strengths and weaknesses and address them. Thus, they function as automated teaching systems that mimic human teachers by analyzing learners' capabilities, identifying their shortcomings, and guiding

them properly during instruction. They also diversify teaching and learning methods and strategies and track the cognitive level of learners.

This variation in teaching methods, learner interaction, problem-solving approaches, and non-algorithmic solution suggestions tailored to individual learning differences is what gives these smart models the desired educational impact. In my view, this has made our era known as the "Era of Knowledge Creation", or more specifically, the Era of Artificial Intelligence—a distinctive period compared to previous ages that relied on conventional, rule-based software. AI systems are built on scientifically precise knowledge in content, preparation, processing, and application. Knowledge today is no longer just about collecting and examining information and deriving relationships; it now involves summarizing it, excluding false data, and linking it with available experience, making it adaptable for use whenever needed.

A key distinction: traditional software is built on the equation Data + Algorithm = Application Program,while AI systems are based on the equation Knowledge + Inference = Knowledge-Based Intelligent System.

Some modern researchers argue it is necessary to develop a contemporary vision for the architecture of smart instructional systems before designing and producing them. This vision would influence the design, choice of authoring tools, programming languages, and styles. While system architectures may differ between studies, they generally revolve around core models: learner individuality and personality, and teacher expertise—which are central elements in instructional design. It is essential to also integrate AI capabilities and expert knowledge using continuous interaction to enhance the efficiency of smart educational programs.
AI contributions to education are extremely valuable, especially in countries with significant experience in digital technologies. These contributions have brought numerous benefits to both teachers and students. In these contexts, AI in education is seen as a convergence of AI sciences and educational technology. Its goal is to deepen understanding among educators and learners about how learning occurs. Therefore, the essence of educational AI must rely on deep integration between AI and education, enhancing the effectiveness of teaching, learning, and educational management.

The most impacted educational areas by AI include: content, teaching methods, assessment, and communication. For example, in communication, intelligent tutoring systems can be used to structure suitable learning paths. In teaching methods, AI can be utilized for personalized learning, even reaching the level of intelligent educational robots.
Smart education technologies based on AI systems have several features, such as: symbolic representation, experimental search, and the ability to handle uncertain or incomplete data. Despite these advantages, there are limitations—for instance, AI tends to over-focus on the rational aspect of human intelligence. Although AI systems cover a wide range of information processing, they often work with pre-determined data. AI excels in deductive reasoning, but lacks the creativity,

distinction, and inspiration inherent in human intelligence. Thus, even with its superiority, AI remains lifeless, an uncreative source of knowledge, and often introduces a routine that discourages innovation.

Nevertheless, these shortcomings do not negate the significant educational value of AI technologies. AI makes learning accessible anytime and anywhere, untied to time or place. It provides flexibility in delivering content suited to learners' abilities and acknowledges individual differences. AI-supported programs focus on teaching essential skills, offering feedback to both students and teachers, and reducing dependence on textbooks.

Moreover, research shows AI is effective in achieving many educational goals, such as deep learning, retention, correcting misconceptions, and developing problem-solving and reasoning skills in information technology education.

Conclusion:

What we know about the curricula and programs developed within artificial intelligence systems is that they incorporate modern teaching strategies and methods aimed at achieving the goals of learning and education, thereby enhancing the overall educational process. Most contemporary scientific studies and research, as we have seen, have highlighted that many teaching methods currently used—apart from those directly related to contemporary technology—are outdated and no longer align with the demands of our era. This points to a practical weakness in implementing current didactic strategies and techniques.

Therefore, many conferences, such as the Fourth International Conference on E-Learning and Distance Education and the Tenth Scientific International Conference of the Arab Society for Educational Technology, have recommended the need to develop interactive electronic learning environments and employ them in ways that align with educational objectives. The need to investigate the impact of modern technologies in learning and teaching has become evident.

As a result, many educational studies have revealed the effectiveness of using artificial intelligence in the educational process. Some studies have demonstrated the effectiveness of neural network-based AI models in improving student achievement, retaining learning outcomes, and correcting misconceptions in science subjects. Other studies have shown how smart educational programs can enhance the skills of educational website developers in building platforms that meet comprehensive quality standards.

Despite these positive findings, there remains a noticeable scarcity of research using artificial intelligence—particularly in the teaching of school subjects—in many Arab countries. This is largely due to the lack of development projects within educational institutions, unlike in the West, where such smart education programs are increasingly common. Only a few Arab countries have begun to introduce related projects, but these efforts remain modest.

Artificial intelligence remains both a science and a technology. It combines multiple fields such as computer science, biology, linguistics, cognitive psychology, mathematics, and engineering,

among others. Its goal is to create knowledge-based systems in specific fields that enable computers to think, see, speak, hear, and move. These systems—referred to as *Knowledge-Based Systems*—are characterized by their abilities in perception, reasoning, inference, and learning.

Interest in artificial intelligence has become a contemporary necessity to keep pace with the transformations of our era, which is referred to as the age of technological renaissance and the information revolution. The use of AI reduces human effort and anxiety, alleviates pressure, and allows for the execution of tasks that may be difficult or even impossible for humans to perform. Studying AI and its applications, as well as moving toward producing intelligent devices, has become a hallmark of progress and innovation. It is thus essential to study AI, understand its applications, and recognize its significance.

However, I conclude by saying that the problem does not lie in artificial intelligence itself, nor in any field of its application. Rather, the true issue lies in the philosophy of the human being—in how people use their intelligence, awareness, willpower, and conscience in what they create, including artificial intelligence. The use of technology depends on those who operate it. The danger is not in the technology, but in its inhumane application.

Therefore, we must not blindly embrace everything that technology—whether human or artificial—produces. No one should feign innocence in the face of the dangers of our time and position themselves as a victim. Humanity does not need to halt progress; it desperately needs to humanize it. The future will only be successful if humanity understands what it means to be human—and where it is headed.

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