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**BALANCING THE BENEFITS
AND RISKS OF AI
LARGE LANGUAGE MODELS
IN K12 PUBLIC SCHOOLS**

a MERC brief

BALANCING THE BENEFITS AND RISKS OF AI LARGE LANGUAGE MODELS IN K12 PUBLIC SCHOOLS

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According to Google Trends, “ChatGPT” ranks 2nd in its “Rising queries” metric in the past 12 months. This spike in attention supports the notion that ChatGPT, and other artificial intelligence (AI) language models are revolutionary technologies that will disrupt many facets of our everyday lives, including how students learn and how teachers teach. Depending upon who you ask, this disruption may be seen as a promise, a threat, or something in between. Indeed, the increased attention to AI has spawned numerous opinion pieces about how educational systems should (or should not) accommodate them, as well as explicit policy statements from K12 school divisions and other institutions. While AI may indeed revolutionize the educational landscape, it can also be considered as the most recent addition to a long line of transformative technological advancements. Throughout the 21st century, numerous hardware devices (such as cell phones, laptops, and tablets) and software applications (including Zoom, Wikipedia, and Google) have significantly altered teaching, learning, and school operations.

The purpose of this brief is to discuss potential impacts of *artificial intelligence (AI) large language models (LLMs)* on K-12 education. It is intended for individuals involved with or interested in K-12 public schools, such as teachers, instructional staff, school administrators, district personnel, local and state policymakers, education school faculty and students, community members, parents, and students.

The brief addresses **the following questions:**

- What is AI? What are AI large language models? How do they work?
- What are the implications of large language models for teaching and learning?
- What are the main concerns with the use of AI large language models? What are the concerns for use within public schools?
- What are the considerations for school district policy on AI large language models?
- What are recommendations for educators and educational leaders?

It is important to note that our discussions of the possible influence of these technologies on public education are primarily speculative. With LLMs having been publicly accessible

for under a year, there is limited time for educators to evaluate their impact. Moreover, the complexity of these models, which even AI experts do not fully comprehend, adds uncertainty to future predictions. Each section of this document relies on internet sources such as news articles, opinion pieces, and resource guides. In the creation of this document, we employed LLMs, like ChatGPT, for idea generation and minor editing assistance.

In our approach to this topic, we adopted a pragmatic approach that both acknowledges the novelty of such technologies and contextualizes them within the larger history of technological developments in education. The brief concludes with **a list of guiding questions for schools and school leaders**. Our hope is that the brief will lead to public discussions of how LLMs might impact our schools, the quality of teaching and learning, and the success of our students.

What is AI? What are AI large language models? How do they work?

Artificial intelligence has become part of our everyday vernacular in recent months due to the release of LLMs such as ChatGPT. However, AI is not a nascent concept; in fact, it [dates](#) back to the middle of the 20th century. "[The Turing Test](#)," meant to test a machine's ability to exhibit intelligence indistinguishable from that of a human, was proposed in 1950, six years prior to the [first-ever AI technology](#). AI has since developed as a subfield of computer science that aims to create intelligent machines, particularly [intelligent computer programs](#), capable of performing tasks that would typically require human intelligence, such as problem-solving, decision-making, speech recognition, and game-playing. To accomplish this, AI relies on algorithms and models to analyze and process large amounts of data, recognize patterns, and perform tasks. LLMs are now possible due to advances in computational power, increases in the amount and availability of data to train models, and developments in neural network architectures that facilitate better model performance.

AI is already integrated into our everyday lives, from [healthcare](#) and [research](#) to [learning a new language](#), and has a multitude of applications, ranging from the mundane to the complex. For example, personal assistants such as Alexa, Google, and Siri utilize *natural language processing* (NLP) and machine learning to interpret voice commands, while AI models have used machine learning to [search for exoplanets](#). These tasks are typically performed through one of the several [subsets](#) of AI: machine learning, neural networks, deep learning, robotics, computer vision, and NLP. OpenAI's ChatGPT is an example of a technology that utilizes NLP. [ChatGPT](#) is part of a family of models called "generative pre-trained transformers" (GPT) that are intended to produce text that simulates human language. Unlike some other forms of AI with extremely specific applications (e.g., identifying exoplanets), GPTs are capable of producing a wide variety of textual outputs that are informed by the input to the model as well as the patterns learned from the training data.

To interact effectively with LLMs, it is critical to understand the concept of [prompt engineering](#). In short, this is the skill of refining the questions or commands one poses to

receive responses best-tailored to one's specific needs. The term stems from the early days of development for these models, when Prompt Engineer was a [job title](#) given to those engaging in chats with AI models as a form of quality assurance and development. The specificity of a prompt can drastically change the results of an interaction with AI models. A less-defined prompt has the potential to lead to information from AI models that may be poorly-aligned with the needs of the user. When more specific instructions are provided, the model will provide better-tailored responses.

Open AI provides the following [guidelines](#) for effective prompt engineering:

- Use the newest version of the AI model
- Start your prompt with instructions, and use quotation marks to indicate the text that should be analyzed.
- Provide specific and detailed instructions, including desired length, format, style, and necessary features.
- Tell the AI model what to do rather than what not to do.
- Avoid using vague words like "about," "mostly," and "fairly."
- Give examples of the desired response format whenever possible.

In addition to these guidelines, many AI models give users the ability to adjust the [parameters](#) of the model's responses. As an example, adjusting the "temperature" of an AI model influences their 'creativity' and likelihood of providing less common answers. Higher temperatures may be appropriate for more creative writing prompts, but would be likely to lead to less accurate responses to fact-based inquiries. Microsoft's Bing chatbot allows users to select the temperature of the response. You can also use parameters to establish a maximum length or omit specific phrases from the AI model's responses.

To effectively integrate AI models into their daily tasks, both students and educators need to become proficient in prompt engineering. Teachers aiming to promote or oversee AI usage in their classrooms should allocate time for prompt engineering instruction. Many institutions are already developing [courses](#) to facilitate this, and tools are being designed to [optimize prompts](#).

What are the implications of large language models for teaching and learning?

AI, including LLMs, will profoundly impact teaching and learning. Teachers can utilize LLMs to alleviate their workload by automating various tasks. For instance, LLMs can help create lesson plans, design assignments, grade papers, and communicate with parents. Here is a list of potential ways to integrate LLMs into teaching and learning. Keep in mind that as this technology evolves within the K-12 sphere, the list will likely expand.

- **Lesson Planning.** LLMs can be used in lesson planning by generating lesson plans, suggesting effective teaching strategies, and providing tailored instructional materials based on learning objectives. These models can create writing prompts,

quizzes, tests, classroom activities, and worksheets, while personalizing content to suit individual needs and learning styles. They can also enhance accessibility for students with disabilities and create adapted lessons for non-native English speakers, making education more inclusive.

- **Delivery of Instruction and Assessment.** LLMs can enhance K12 instruction and assessment by providing personalized tutoring, assisting teachers in grading assignments, and identifying potential biases in assessment practices. This enables a more efficient, individualized, and equitable learning experience for students.
- **Professional Development.** LLMs can enhance professional development by providing personalized opportunities tailored to the specific needs and interests of educators.
- **Parent and Community Engagement.** LLMs can support parent and community engagement for K12 teachers by crafting engaging and interactive outreach materials. These models also facilitate communication with diverse families by translating content into various languages.
- **Administrative Duties.** AI large language models can streamline administrative duties for K12 teachers by automating tasks like report generation, reducing manual workload. Additionally, they can aid in the development of policies and programs, promoting efficient educational practices and fostering a more effective learning environment.

In planning for the potential integration of LLMs within educational settings, it is also critical to anticipate the potential ways a student may use these tools. While early media attention on this activity has centered around the plagiarism risk of AI being used to write essays whole-cloth for students, there may be ways for students to integrate LLMs into their day-to-day work that are less disruptive, and could potentially support student learning.

- **Research Assistance.** LLMs can aid students in research by assisting with topic exploration, answering questions, and offering valuable resources to enhance understanding. While similar to search engines, these models can identify relevant articles and provide links, they can also summarize key trends, making the research process more efficient and effective for students.
- **Writing Assistance.** LLMs can offer writing assistance to students by helping with essays, papers, and other academic writing tasks. Students can input their ideas, and the AI model will generate suggestions, provide feedback, and refine their writing. Additionally, these models can produce example outlines, paragraphs, and written content, while offering editing and feedback on various aspects such as style, grammar, spelling, and syntax, enabling students to produce well-structured work.
- **Study Assistance.** LLMs can serve as highly valuable study aids for students by creating practice questions, quiz questions, and flashcards, as well as offering explanations and demystifying complex concepts. Additionally, these models can help devise personalized study plans tailored to upcoming tests and exams, promoting efficient time management and comprehensive content review. However, it is important to note that LLMs are not specifically designed to solve math problems and may occasionally generate inaccurate answers.

- **Personalized Learning.** While instructional differentiation is not a novel concept, LLMs have the potential to transform its implementation in the classroom. Emerging tools like [Khanmigo](#) offer real-time feedback and tutoring, enabling personalized learning experiences for students.
- **Language Learning.** LLMs can significantly enhance K12 students' language learning experiences by explaining complex topics like grammar, conjugation patterns, and speech conventions tailored to their level. These models can serve as conversation partners for text-based chatting, provide examples of vocabulary, sentence structures, and rules in other languages, and offer feedback on students' language use.
- **Self Advocacy.** LLMs can support students' self-advocacy skills by assisting in crafting emails, letters, or written appeals to faculty, staff, or parents. Additionally, these models serve as conversation partners, allowing students to practice discussing challenging topics in a safe and supportive environment.

What are the main concerns with the use of AI large language models? What are the concerns for use within public schools?

The recent surge in the prominence of LLMs has spawned a great deal of attention and [concern](#) surrounding the ethical and safety [challenges](#) they present. These include concerns about the likelihood of LLM content to be biased, inaccurate, or offensive. There are also concerns about privacy and possible surveillance through these systems. Responding to these concerns, companies currently leading AI efforts have drafted frameworks for responsible use, such as [Microsoft's Responsible AI Program](#). These guidelines encourage governance structure, rules, training, and practices for employees, as well as tools and processes for implementation. While moves toward self-regulation may signal to the public that ethics and compliance in the development and use of AI are a priority, there is evidence that the pressure for growth has [the potential to sideline ethical oversight](#). Consequently, there has been a push among [independent AI researchers](#) for public discussion and the establishment of regulatory guardrails. In fact, researchers have stood in front of the Senate [to implore that these protections be established](#). The founders of OpenAI have joined this [call for regulation](#) and released a [document](#) that included an outline of the observed safety challenges of GPT-4, such as [hallucinations](#) or the tendency of LLM to produce incorrect or nonsensical information.

In [educational contexts](#), a range of specific concerns related to LLMs emerge.

- **Academic integrity.** LLMs generate responses by processing the input to the model in combination with the patterns derived from the vast corpus of text on which it has been trained. As such, it is capable of generating responses to a variety of questions, including long-form responses to essay prompts. The model's ability to quickly write essays for students has given rise [to concerns about plagiarism and other forms of academic dishonesty](#).

- **Student privacy.** Teachers may unintentionally expose information about students by using LLMs. When educators use LLMs, the models may collect personal information that is included in the input, file uploads, or feedback that users provide (see for example [Open AI's privacy policy](#)). Such data could potentially include sensitive information about students, such as their names, ages, and academic performance. To protect student data privacy, it is important to ensure that LLMs comply with relevant laws and regulations, such as Family Educational Rights and Privacy Act ([FERPA](#)) in the United States.
- **Inappropriate content.** LLMs may generate responses that include inappropriate or offensive content, such as hate speech, harassment, or sexual content. It is important to monitor responses and implement filters or other controls to prevent inappropriate content from being displayed to students. The creators of LLMs built content filters and safety features, however, these safety walls can be [breached](#).
- **Biases.** LLM responses may also reflect [biases](#) inherent in the data used to train the model. Bias can take different forms and types: racial bias, gender bias, age bias, socioeconomic bias or political bias. This could lead to unfair or discriminatory responses that negatively impact students. It is important to monitor LLM responses for bias and take steps to correct any issues that arise.
- **Student overreliance.** While LLMs can certainly be used as a [supplemental teaching tool](#), claims have been made that these technologies will create student dependency on technology which will affect skill development, lead to an erosion of critical thinking skills and a diminished ability to analyze information. While LLMs can help generate content and answer questions, they may not always provide accurate or contextually appropriate information, which can be detrimental to the learning process.
- **Teacher overreliance.** Educators may adopt these LLMs without a clear pedagogical framework. This lack of standardization can lead to confusion among students and an uneven learning experience, ultimately undermining the potential benefits. It is also important to note that the extent to which AI technologies replace teachers' work raises concerns about the deskilling and possible replacement of educators. As automated systems take over more responsibilities, the role of the teacher may become diminished, leading to a loss of expertise and potentially even job loss in the education sector. Furthermore, the human element, which is vital for fostering empathy, understanding, and social-emotional growth in students, may be compromised.
- **Equity considerations:** While thoughtfully implemented LLMs can improve access to high-quality learning experiences for traditionally underserved students, past experiences demonstrate that new technologies can be unevenly distributed across educational systems. Consequently, this may result in varying learning experiences for students in different schools and classrooms. For example, some students might be able to use these tools to develop critical thinking skills, while others may not have equal opportunities. To maximize LLMs' positive impact and minimize disparities, it is crucial to ensure equitable access and usage in education.

Given these concerns, it is essential for educators to be aware of potential drawbacks associated with educational technologies and actively address them. This may include

creating well-considered policies for technology usage, scrutinizing materials for bias, promoting consistent teaching methods, balancing LLM usage with human instruction, and highlighting the indispensable role of teachers in the learning process.

What are the considerations for school district policy on AI large language models?

In the face of the concerns about LLMs, several large K12 school districts have already instituted bans on their networks and/or the devices they provide to students. Among the districts that have banned LLMs are [New York City](#), [Los Angeles](#), [Baltimore](#), and [Seattle](#). In a public statement justifying their ban, New York City Public Schools [cited](#) “concerns about negative impacts on student learning, and concerns regarding the safety and accuracy of content...” Within the Commonwealth of Virginia, Fairfax County, the state’s largest school division, [banned](#) LLMs on all county-issued devices as of January 2023. Furthermore, in a recent town hall meeting held in Richmond, VA, and broadcast nationally on CNN, Governor Glenn Youngkin [argued](#) that more school divisions in the state should ban LLMs, citing his concern that “if a machine is thinking for [our students], then we’re not accomplishing our goal.”

However, the [reaction](#) to LLMs has not been uniform across the nation's largest school districts. For example, Chicago Public Schools and Philadelphia Public Schools have not banned LLMs. Other districts, like Prince George (Maryland) and Orange County (Florida), have not imposed a ban but are exploring ways to address student and teacher usage. The lack of a ban could partially stem from logistical concerns, as many students have access to laptops or devices capable of utilizing LLMs. Additionally, recent announcements from Microsoft and Google indicate plans to integrate LLMs into work products such as email and document editors. Consequently, a district-wide ban on AI tools might be short-lived.

When formulating policies, educators and administrators should carefully evaluate how students' and teachers' potential use of LLMs aligns with their educational objectives. These may encompass student learning goals (such as course standards), school improvement goals, or goals outlined in division strategic plans. Subsequently, the policies they develop should be consistent with these goals. As with behavioral expectations, these policies should clearly define what is and is not acceptable. Acceptable use may vary depending on the specific goals. For instance, if a learning goal requires students to summarize an article, it would likely be inappropriate for a student to ask an LLM to do the summarizing. On the other hand, if the learning goal is to comprehend how figurative language contributes to an author's voice, it might be acceptable for students to request an LLM to [generate similar content](#) in various styles and then analyze the produced text.

That said, it seems that some areas of policy relating to ChatGPT and other AI tools will be universal. For instance, policies should prohibit exposing sensitive data (e.g., data protected by FERPA) to external AI systems unless such sharing is explicitly covered by a data-sharing agreement. Likewise, policies ought to ensure that any district-, school-, or teacher-level

usage of AI systems is transparent (in the spirit of the [Freedom of Information Act](#)). After determining what these “non-negotiables” are, divisions may be in a better position to consider outlining more contextual use policies such as those described previously.

What are the recommendations for educators and educational leaders?

With LLMs, as with numerous past technological advancements, educators need to determine how and to what degree they should integrate them into schools. In making these considerations, we suggest the following:

- **Keep abreast of new advancements.** LLMs and other AI models are developing rapidly. We suggest that, at a high level, educators try to be aware of the capabilities of current models so that the responses to these technology changes are proactive rather than reactive.
- **Adopt explicit policies regarding AI usage.** Whether at the district-, school-, or classroom-level, we suggest educators and educational leaders create policies explicitly describing acceptable and unacceptable uses of LLMs. These policies ought to align with established goals of the school district.
- **Enhance media literacy curriculum to include critical understanding of LLMs.** LLMs will have a profound impact, not only schools, but also on the broader media environment. In preparation for engaged citizenship, students need to understand how these tools can be used and misused across society.
- **Teach students how to use LLMs appropriately.** Students should be taught about the potential benefits and risks of LLMs, and provided guidance about ethical use.
- **Embrace opportunities to scaffold teacher work.** LLMs can support teachers in many ways. Acknowledging that these tools may produce “rough draft” work rather than “final products,” they can nevertheless considerably lessen teachers’ workloads. This may be especially important given Virginia’s current [teacher shortages](#).
- **Provide teacher professional development on LLMs.** Teachers may need professional development to understand the ways LLMs can be used within their work to support student learning, as well as the ways it may undermine the teaching and learning process. For example, teachers should develop skills in reviewing and auditing content for bias, and identifying overreliance. Tools like [GPTZero](#) can help detect plagiarism and AI-made content, [although the effectiveness of these tools is not clear](#).
- **Purposefully disconnect where appropriate.** Recognize that most learning probably doesn’t need to be mediated through LLMs. For instance, research suggests that hand-writing notes (as opposed to typing them) can [improve encoding information](#), and it also attests to the [utility of physical manipulatives](#) when learning math concepts. We suggest that educators continue to pursue research-based instructional practices that intentionally disconnect from AI. Teachers also need to consider how using this technology in conjunction with traditional teaching methods can support personal connection with students.

It is tempting to view LLMs and other forms of AI with skepticism - and indeed, some have already begun to view them with fear. In the past, when similar tools were introduced, many in education moved to limit student access to them. Students will likely continue to identify novel uses for generative AI. By embracing these new ideas with curiosity, we may be able to identify uses for AI that benefit many.

Questions for schools and school leaders

Our hope is that the information in this brief will lead to public discussions of how LLMs might impact our schools, the quality of teaching and learning, and the success of our students. Below is a list of guiding questions for schools and school leaders.

1. How, and to what extent, are LLMs currently in use in our schools among students and teachers?
2. How can LLMs best be integrated into the K12 curriculum to enhance learning outcomes and foster critical thinking skills?
3. How can LLMs be used to support personalized learning, taking into account individual student needs, abilities, and interests?
4. What ethical considerations should be taken into account when deploying LLMs in K12 education, such as potential biases or privacy concerns?
5. How can educators ensure equitable access to LLMs for students from diverse socioeconomic backgrounds, ensuring that no one is left behind?
6. What professional development opportunities should be provided to educators to help them effectively incorporate LLMs into their teaching practices?
7. How should educational leaders assess the effectiveness of LLMs in the classroom, including their impact on student achievement and engagement?
8. In what ways can LLMs facilitate collaboration and communication among students, educators, and families, and how can potential challenges be addressed?
9. How can K12 schools work with AI developers and university researchers to ensure that LLMs are designed and updated to best serve the evolving needs of the education system and its stakeholders?



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