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Artificial Intelligence and Education: End the Grammar of Schooling

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Abstract

Purpose: The purpose is to stimulate imagination of artificial intelligence (AI) and education beyond current schooling.

Design/Approach/Methods: The approach this article took is a broad review of literature on learning, teaching, schooling, and technological development and evidence-based reasoning about the possible future of education in the context of AI.

Findings: Schools could be transformed with the advancement of technology, especially generative AI. The changes should start with student-driven personalizing learning and problem-oriented pedagogy.

Originality/Value: The value of the article lies with the unique definitions of personalized learning and problem-oriented pedagogy as well as the contribution of AI to support a new form of learning.

Keywords

Artificial intelligence, education reform, educational technology, learning, teachers

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Too much has been written and spoken about artificial intelligence (AI), especially generative AI, in education. Since the public release of ChatGPT in November 2022, AI has taken the central stage in educational discussions. Numerous conference presentations, journal articles, and books have appeared, all trying to suggest, recommend, and predict the future of AI uses in education. But most of the discussions, regardless of their scholarly quality, are primarily focused on using AI in the traditional arrangement of schools or following the "grammar of schooling" (Tyack & Tobin, 1994). The assumption is that everything the traditional school has operated with shall remain the same: curriculum and curriculum standards, age-based grouping, fragmented knowledge or subjects, standardized assessments, and teacher-centered classrooms. AI tools, according to most of the advice, are to be incorporated into teaching by teachers just like previous technologies.

Even the most recent books that advocate for teaching new skills and using new pedagogies such as *Education for the Age of AI: Why, What and How Should Students Learn for the Age of Artificial Intelligence?* (Fadel et al., 2024) and *AI in Education: How Teachers & Educators Can Create Personalized Lesson Plans, Provide Real-Time Feedback, and Help Students Reach Their Full Potential Using Artificial Intelligence* (Robert, 2024) follow the most basic principle of traditional schooling: one-size-fits-all. That is, one program, one expectation, one pathway, and one organization for all students. The proposed what and how of learning may have changed, but they apply to all students. Even the so-called personalized learning is to support one-size-fits-all by allowing students to vary slightly in the process of learning (Zhao, 2016c).

What if we consider education in the age of AI without thinking about the existing schooling system? We know that schools are extremely resilient social organizations. They have not changed much since their conceptualization in the nineteenth century despite numerous efforts (Cuban, 1993, 2001; Goldin & Katz, 2008; Tyack & Cuban, 1995). But a thought exercise that does not bind education within the schooling system is valuable because it at least can point out directions where education policy makers and practitioners could work toward.

Personalized learning: Meet the same expectations or develop unique greatness

When asked how AI can be used in education, virtually all AI systems such as ChatGPT, Gemini, and Perplexity, mention enabling or supporting "personalized learning" as the first item. In other words, these large language models (LLMs), which analyzed and synthesized available literature, agree that personalized learning is important, and AI can contribute significantly to personalizing learning. Indeed, personalized learning has become one of the holy grails in education in recent years. As far back as 1984, Benjamin Bloom proposed one-to-one tutoring is more effective

than group instruction (Bloom, 1984). With the advancement in technology, personalized learning has become a widely accepted and promoted strategy in education in recent years (Bray & McClaskey, 2014; Hattie, 2009). A large amount of research has also shown that personalized learning seems to yield effective positive outcomes (Bernacki et al., 2021; Pane et al., 2015a, 2015b; Shemshack & Spector, 2020).

However, this version of personalized learning is not the same as personalization of learning. It is simply an improvement of traditional schools' one-size-fits-all. Pane, who led the large RAND Corporation review of personalized learning, suggests that although there is no clear definition of personalized learning, it seems reasonable to believe that:

> Personalized learning prioritizes a clear understanding of the needs and goals of each individual student and the tailoring of instruction to address those needs and goals. These needs and goals, and progress toward meeting them, are highly visible and easily accessible to teachers as well as students and their families, are frequently discussed among these parties, and are updated accordingly. (Pane et al., 2017)

The essence of personalized learning is to create individualized paths for students, adjusting the difficulty and pace of the material based on their progress and understanding. It can be done by computers and/or teachers. Although the word "personalized" seems new, the basic idea is the same as individualized learning, customized learning, and differentiated instruction. In many ways, it carries on the tradition of Skinner's teaching machine in the 1950s (Watters, 2023).

The basic idea underlying personalized learning is that students are different, but we want them to have the same achievement in the same set of school subjects at the same time. However, their differences make them learn in different ways, they progress at different speeds, and they may have different interests in different styles of instruction, learning, content, and materials. To accommodate their differences so they can have the same achievement, learning needs to be customized and instruction needs to be differentiated.

Another version of personalization

Another version of personalized learning is drastically different. It does not aim to help all students achieve the same outcomes. It is not to allow students to move along the same path to the same goal. Instead, it is to help each student to become uniquely great in their own way.

The new version of personalized learning has several assumptions that are more appropriate in the age of AI. First, it accepts the widely accepted idea that each child is born with different intelligences or capacities for learning (Gardner, 1983; Sternberg, 1985), different personalities (John et al., 2008), and different interests or intrinsic motivations (Reiss, 2000, 2004).

Second, these natural and innate differences serve as the foundation of further development and learning after birth. Their social environments in the family and community as well as their accessed technology and media environments give them different experiences which shape their development in different ways through an almost random process of interaction with their natural talents, interests, and personalities (Lewontin, 2001; McDiarmid & Zhao, 2022; Ridley, 2003). So when children arrive at school, they are already specialized individuals (Hatch, 1997).

Third, traditional schools typically follow a set of curriculums and standards and have specific type of expectations. Judged under the traditional school expectations, these specialized individuals become quite divers: Some are great, some are average, and some are below or way below average. What schools typically do is to serve the average and let the advanced students move into gifted and talented programs and provide remediation to those below the average. In other words, the traditional approach is to fix the deficit of individuals to make them the same.

Fourth, we have arrived at a time when we need to question if fixing deficit in individual children is the right approach (Zhao, 2016b). Since every child has strengths and deficiencies, we should shift our mindset of education toward developing the strengths of each child instead of fixing their deficiencies.

The rise of individual greatness

This proposal can be challenging to accept but makes tremendous sense today because individuals with average capabilities are more likely to be replaced by technology or outsourced to low-cost regions of the world (Rose, 2016; Zhao, 2007, 2012). In the age of AI, when most physical labor jobs had already been outsourced or automated, AI-driven technology is to disrupt professional jobs that are better paying and require better-educated workers (Muro et al., 2019). While no one can predict the future of AI and its possible impact on society, it is reasonable to believe that AI and related technology will replace many more mundane and repetitive jobs in a wide range of professions (Cox, 2023; Saleem, 2023; World Economic Forum, 2020). In other words, if a job can be replaced and is worth replacing, it will likely be replaced by AI-driven technology.

But at the same time, AI has created and will continue to create new potentials for jobs. The challenge is whether we can educate our students to take advantage of the potential to create jobs. To take advantage of the AI potentials to create or reshape jobs requires agency, creativity, entrepreneurial thinking, and most importantly deep knowledge and master-level skills. That requires a different kind of education.

The new type of education should focus on developing great individuals instead of average members of a workforce (Zhao, 2018b, 2018c, 2023). To develop great individuals, we must consider the starting point of each child. As mentioned before, every child is a young specialist

when they arrive at school. Every child has strengths. No matter where they come from, every child is better at something and worse at others. The twice-exceptional children research shows that gifted children in some areas can also have extremely challenges in other domains (Foley Nicpon et al., 2011; Reis et al., 2014; Ronksley-Pavia, 2015; Trail, 2021). The gifted children can also be placed in special education programs and likewise, special education students can also be gifted. Accepting that each child is unique and has strengths instead of focusing on their deficiencies in adult-approved areas is the first step toward a new version of personalized education.

Another step is to accept that any potential talent, when fully developed, is valuable today (Zhao, 2019). Traditionally schools have been charged to teach what adults and systems determine to be important and useful for children in their future lives, but societal changes over the past few decades have made all potential talents to be important and useful. The usefulness is dependent on the talent used.

The traditional approach toward fixing children's deficiency has not worked well. The reason is very simple: Those students who are ahead do not wait for those who are behind. Moreover, assuming all students spend about the same amount of time learning the same subjects (Ericsson & Pool, 2016), those who are already ahead will always stay ahead.

However, if all children spent the same amount of time developing their own strengths, the situation is quite different. If 10,000 h is required for developing true expertise (Gladwell, 2008) and each child spends that time developing their own strengths, the child will become a true expert. But if the 10,000 h are spent on fixing their deficits or developing what they are not good at or passionate about, the results would likely be they become mediocre at best.

Problem finding and problem solving: Creating value for others

Besides supporting personalized learning, AI has also been said to have great power in assisting project-based learning (PBL). Again, PBL has, for decades, been advocated as an effective and meaningful learning approach (Warren, 2016; Wurdinger, 2016; Zemelman, 2016).

But PBL is not what we need in the age of AI (Zhao, 2012). It still falls in the traditional educational design. It may teach students better skills in inquiry, thinking, collaboration, creativity, and deeper knowledge, but it is still focused on having students master the same pre-determined curriculum.

Find and solve problems for others

In the age of AI, the first thing students need to do is to find problems worth solving because when they enter the society, they need to create value for others using their unique greatness

(Zhao, 2022b). With AI and related technology, human greatness can be drastically enhanced. Distributed cognition theory has long advocated that human cognition and knowledge are not confined solely to the individual. Instead, cognition is a process that involves the individual, the environment, and the interactions with other people and objects in the environment (Hutchins, 1995). With AI serving as intelligent assistant, individual human beings can be greatly more productive and creative. However, this greatness needs to find applications.

Finding problems is to find the place to apply the greatness. If individuals can find a problem, a worthwhile problem, to solve, they have in essence discovered the value of their greatness, but it is also important for the individuals to understand that the worthwhile problem needs their greatness, their portrait of special talents, skills, and interests, to solve. This is why when students propose a problem to solve, teachers should ask three questions to help them refine the problem: why this problem, why you, and why now?

Traditionally, entrepreneurship education aims to teach students to develop problem-finding mindset and skills because all entrepreneurs must be sensitive to problems, which create opportunities for entrepreneurial actions (Choo & Wong, 2006; Zhao, 2012). Today, everyone needs to have an entrepreneurial mindset as everyone has the potential, opportunity, and perhaps necessity to create solutions to problems with the assistance of AI.

Teaching students to identify problems has not been in the tradition of schools, which have typically focused on teaching known solutions to known problems. Thus, teachers and students are likely not used to identifying problems, which can take a long time. However, identifying worthwhile problems can awaken children's interests and passions, which again have typically been suppressed by traditional schools. It also helps students to understand themselves better. This long process of finding the problem, through multiple iterations, that individual students are passionate about and capable of solving should be the beginning of all teaching.

After finding the problem is the process of problem solving. This is again a long process of creating initial solutions, seeking feedback, revising and improving. Ultimately, the students are expected to create a solution that meets high standards. PBL talks about the process, while problem-based learning is about both: the process and the products. Only when high quality products are produced can students feel an authentic sense of pride and accomplishment.

Human interdependence

Finding and solving problems as a pedagogy teaches students to care about their own efforts and strengths. Through making meaningful solutions to worthwhile problems students learn to understand what is valuable to others and the world. When they produce genuine solutions to authentic problems that matter to the world and others, they achieve "genuine happiness" (Seligman, 2002).

Finding and solving problems also teaches students about genuine collaboration, which is the application of social intelligence (Zhao, 2016a). When they learn about their own strengths and weaknesses, they also learn about the strengths and weaknesses of others. They can then learn to seek help from others so others can contribute to their projects and vice versa. Students develop the mindset that all humans are independent. Unlike traditional schools that force all students to learn the same curriculum and rank the students based on their performances, which in essence teach students to compete with each other, finding and solving problems teach students about human interdependence. The collaboration is not only done with peers in the local contexts. Students are also able to use LLMs, online videos, social media, and experts from afar (Zhao, 2021).

Through the process of finding and solving problems, students also learn to understand that using knowledge is much more important than memorizing it. They acquire knowledge to find and solve meaningful problems. They find the knowledge and apply it creatively to immediate problems. Learning is not just in case the knowledge may be useful in the future. Instead, learning is action and action is learning. Actions build on actions and lead to deeper and broader understanding of knowledge in certain domains.

Education needs transformation

The proposed version of personalized learning to promote individual greatness and the pedagogy of finding and solving problems requires schools to drastically change. They require schools to transform into something else instead of simply improving within the current framework of schools. Such a requirement is not only necessary for education to meet the needs and affordances of the age of AI, but also necessary for meeting even the basic needs of traditional educational excellence and equity because current school systems cannot seem to be improvable.

The formal school system has gone through historically significant reforms in almost all countries over the past several decades (Zhao, 2018d; Zhao & Gearin, 2018). Western countries such as the United States, the United Kingdom, and Australia have changed their curricula, pedagogy, and staffing requirements and implemented standardized testing to monitor student and school performance as well as holding schools accountable. East Asian systems such as Chinese mainland, Japan, Chinese Taiwan, South Korea, and Singapore have also attempted to change their education toward more flexibility. There is also OECD's Programme for International Student Assessment, better known as PISA, that has been fanning a movement of global learning that touts the PISA lessons (Barber & Mourshed, 2007; Burkitt & Mahtani, 2012; Jensen, 2012; Schleicher, 2016, 2018; Tucker, 2011a, 2011b, 2014, 2016). These reforms have been coupled with increased spending in education. For example, in the United States, the average K-12 per student spending

increased from US$2,272 in 1980 to US$14,420 in 2020. The spending doubled from the year 2000 to 2020 (Statista, 2024). Educational spending in OECD countries has increased dramatically as well. In just 7 years, from 2012 to 2019, the annual rate of increase was 1.7% with no annual increase in the student population (OECD, 2022).

However, education has not improved over the past few decades despite the impactful reforms and significant increase in spending. The most recent PISA results from the 2022 round in fact show a significant decline in the OECD average math and reading scores since 2018. The bigger picture is that all three subjects, math, science, and reading, have experienced decline in PISA scores since the beginning of the assessment. The drop happened in almost all countries, including the United States and Finland, which supposedly has the best education system in the world. In fact, the drop in math, reading, and science PISA scores in Finland from almost two decades ago is the largest (or second to largest in reading) among all countries (NCES, 2023; OECD, 2023).

Equity has not got any better either, according to PISA. The 2022 results show that socio-economically advantaged students scored 93 points higher than disadvantaged students in math across OECD countries. Moreover, in 22 education systems, the gap caused by socio-economic status was higher than 93 points. The performance gap attributed to socio-economic status has remained the same since the beginning of PISA globally and it does not show any sign of disappearing (OECD, 2023).

The PISA data give us a global view; it is also corroborated with some local data. For example, the U.S. long-term trends assessment the National Educational Assessment Program or NAEP found that American students' reading and math scores have not improved significantly since the 1970s. The achievement gap among different groups of students has not narrowed significantly either (Hansen et al., 2018; Hanushek et al., 2019a, 2019b; National Assessment of Educational Progress, 2021) despite the numerous efforts to close the achievement gap (Hess, 2011). The same is true with the situation in Australia. Its national assessment program, NAPLAN, showed no change in test scores since its inception over 10 years ago (McGaw et al., 2020).

If we believe test scores are good indicators of education, we can claim that the world's education has not improved, in fact, it has declined over the past several decades despite the reforms, the international borrowing promoted by PISA, and the increased educational investment. We could have a number of different interpretations of these test results. First, we could admit that the reforms have not improved schools in different countries. Instead, they have disrupted schools' institutional traditions, local community cultures, and school operations. The PISA lessons or whatever international borrowings are not necessarily the best ways to improve education (Zhao, 2018d, 2020). For example, the PISA lesson that good education systems rely on high-quality teachers, who graduate from high school with high test scores (Barber & Mourshed, 2007), is largely a

myth that does not work with reality (Grönqvist & Vlachos, 2016; Zhao, 2018e). In other words, the international borrowing and assessment have made education worse.

Second, we could think that the test scores do not really indicate the quality of education. They fail to measure what students have learned or have been taught (Labaree, 2014; Zhao, 2020). Students may have learned skills and knowledge that are not measured by these tests. If so, we should abandon these tests, but more importantly, we need to consider how we might know if students have learned things besides what has been tested.

Third, another possibility of interpretation is that schools cannot be improved. That is, the design of schooling has its limitations. No matter what is tried, any tweak to the schooling system will not make it improve in excellence or equity. The tinkering toward Utopia idea will always be on the journey toward Utopia but the Utopia can never be realized (Tyack & Cuban, 1995). This is not surprising. Any design has its limitations. For example, it is impossible to improve the horse wagon to make it reach the moon or the Mars. The power of the horses is limited, so is the design of the wagon.

If we accept this interpretation, we believe that the current schooling system, largely borrowed from the Prussian school system in the nineteenth century, does not have any possibility to be improved in excellence and equity. So far, educational excellence is primarily defined as excellent test scores in a few core subjects such as math, reading, and science. Equity is largely defined as small or no gaps in test scores among different groups of students. PISA follows this definition, so do educational systems around the world. As discussed before, PISA scores, NAEP scores, and NAPLAN scores have indicated that education systems have not been improved to bring more equity and excellence over the past few decades. There is no reason to believe that more reforms, more innovations, and more disruptions in curriculum design, assessment, accountability, pedagogy, and staffing could bring better excellence and equity for entire education systems.

The way the education system has been constructed and refined does not allow students to be equally excellent because it is designed to select students based on a fake idea of meritocracy (Zhao, 2016b). All students, regardless of their innate talents, family environments, and community conditions, are brought together to compete against each other in a few core subjects. The winners receive better opportunities in education, employment, and life. In essence, the system has to produce winners and losers using some sort of criteria. And the criteria that have been used happen to be what the powerful, wealthy, and authoritative are good at: test scores in reading, math, and science. As a result, the disadvantaged can never catch up with the advantaged. The achievement gap can never be closed no matter how hard we try (Cobbold, 2017; Hanushek et al., 2019a; Hess, 2011; Reilly, 2020; Valant & Newark, 2016; Zhao, 2016b).

Moreover, the definition of excellence as good test scores is problematic, so is the definition of equity as gaps in test scores. There is no empirically convincing data to show that the tests actually measure abilities or knowledge that matter in the twenty-first-century society and economy

(Zhao, 2020). They are at best measures of the most basic skills and knowledge or the "floor" expectations for every student (Zhao, 2021).

There is no consensus about the definition of educational excellence, but it seems that everyone would agree that an excellent education helps everyone become a good citizen of a society, a member of a productive workforce, and a happy and prosperous individual (Cremin, 1964; Education Policies Commission, 1944; Spencer, 1911). These educational outcomes are not new and have been endorsed by many. But what would help individuals become responsible citizens, a productive member of a workforce, and a happy and prosperous person changes in different societies. Many have argued that in the twenty-first century, traditional memorization of knowledge, reading and math are no longer sufficient for prosperity and survival. There are also many new skills, attributes, and capabilities proposed (Barber et al., 2012; Duckworth, 2016; Duckworth & Yeager, 2015; Dweck, 2008; Pink, 2006; Trilling & Fadel, 2009; Wagner, 2008, 2012; Zhao et al., 2019).

These newly proposed skills and capabilities definitely need a new way of learning. The one-size-fits-all "grammar of schooling" has been challenged for many years for its failure to meet the needs of every student and the demand for customization, individualization, and personalization has been promoted for decades (Basham et al., 2016; Kallick & Zmuda, 2017; Kallio & Halverson, 2020; Pane et al., 2015b; Tomlinson, 2001, 2014). It has also been argued that individuals must focus developing their innate strengths and passions to thrive in a highly personalized society (Gardner, 1983, 2006; Reiss, 2004, 2008; Zhao, 2016c, 2018b, 2018c, 2019, 2021). Thus, the new education needs to be strengths-based and passion-driven. As discussed earlier, rather than focusing a person's deficit, education needs to focus on capitalizing individual's talents and interests and help them become great in their own ways (Zhao, 2016b, 2018b, 2018c, 2023).

To fix education, we need to destroy it (Howard, 2012).

AI and the future of education

If traditional schooling is to be destroyed, AI can be tool. Of course, we must be reminded that schools are extremely resilient social institutions. They have weathered numerous rounds of movements of bold, revolutionary changes and remain almost intact (Cuban, 1990, 1993; Sarason, 1990; Tyack & Cuban, 1995). Whether AI can change schools is not dependent on wishful thinking, but on the actual work of education leaders, educators, students, parents, and the public. So, the changes proposed below are merely invitations for reimagination of schools in the age of AI.

Do we still need a curriculum?

Personalized learning is to help individual students develop their unique strengths and pursue their interests; the pre-determined curriculum is to impose on all students the same content, knowledge,

and skills. The curriculum is typically government-mandated or determined by authorities based on their perspectives of what students need to learn in order to become functional citizens and productive workers. It is typically divided into different subjects in schools.

Personalized learning needs students to learn from beyond and outside the curriculum so as to develop their own strengths and follow their interests. Students can use AI and other resources to shape their own strengths-based and passion-driven journey. They do not need to be constrained to the curriculum-based school subjects. And since AI is not divided by subjects, nor grades or age, or curriculum standards or expectations, the traditional curriculum is becoming irrelevant.

Of course, in the beginning, we can imagine that there may be students who would benefit from following the curriculum. Governments and school systems could still require students to take a pre-determined curriculum in order to impose similar knowledge, skills, attitudes, perspectives, and behaviors on all students. But it is still possible for schools to consider reducing mandated curriculum to give students more time to pursue their own learning. For example, it is possible to consider that governments could mandate one third of the curriculum and schools mandate another one third. Students could control 40% of their time to pursue their own learning (Zhao, 2021).

Do we still need to organize students into age-based classes?

Schools have traditionally organized students into classes based on biological age with the assumption that students of the same age (despite the 365-day difference) are homogenous in their levels of cognition, physical development, and psychological conditions. This is of course not true but the tradition has continued with a few exceptions such as Montessori schools, which groups students across ages. Personalization of learning could change this for all schools. If students are enabled to pursue their own strengths/interests and find and solve meaningful problems, the format of learning organizations can be completely different.

For personalized learning, group instruction may not be needed in the traditional sense. Students do not sit together listening to teachers in certain room and at certain time. Instead, learning becomes self-directed (Candy, 1991; Garrison, 1997). Students pursue their own learning with AI tools, peers from within and outside their school, online resources, and experts. The age of students does not matter anymore. What matters is their competency and interests as well as the problems they are working on. Hence, age-based organizations of students are no longer needed.

What would teachers do?

Teachers are still needed but their role would change dramatically (Zhao, 2018a, 2022a). Since no group instruction is needed and students primarily learn on their own in a self-directed way, teachers do not provide instruction on the content anymore. Their primary job is to work with students in small groups or individually.

They serve as coaches and mentors to students (Fehring & Rodrigues, 2017). They work with individual students to help them discover and develop their strengths and passions. They provide stimuli and feedback to help students identify and refine their problems and solutions. They provide emotional support to students to help them overcome challenges and setbacks. They also create an educational context in which failure is a source of learning, improvement is constantly sought after, and feedback, including peer feedback, is always appreciated.

Teachers are also avid users of AI tools and understand their limitations and biases. AI changes fast and has many known and unknown problems. Teachers need to keep constantly updated so as to model creative uses of AI as learning partners and help students develop better understanding and skills using AI for learning and problem solving.

Is standardized assessment still needed?

Standardized testing has been a dominant feature of modern education. It may not be needed in personalized learning and problem-based learning as students' learning and progress will be highly individualized and demonstrated in the problems identified and solved. Instead of assessing students using standardized tests, future assessment must be contextualized in actual scenarios and follows each student's personalized learning journey. With the data-collection and analyzing power of technology, it is fairly easy to construct big-data-driven assessment systems for individual students.

Standardized assessment may still be needed for measuring if students have met the basic requirements of governments or school systems in areas such as citizenship. But these assessments have to be altered because AI already can perform better than most human beings on human-created assessments. It does not make sense to force students to take these tests if machines can do them. The new assessment needs to be a lot more creative and cannot be done by AI tools.

Conclusion

AI is no doubt a powerful technology but it is easy to underestimate its power. Uses in the traditional classroom to assist students and teachers in learning and teaching definitely helps, but they also minimize the transformative power of AI. Teachers have been prepared to teach the traditional curriculum in the traditional classroom for a long time. AI certainly makes it more efficient and cuts down class preparation time for teachers. It also certainly helps students with their learning tasks and homework. But these uses do not truly transform education.

Moreover, AI is much more than a better search engine that gives answers to questions. Generative AI systems is more of an assistant that needs the right prompts, multiple iterations of queries, and a variety of efforts to guides in order for it to perform properly. It can take a while

for AI systems to learn to do the right thing for human beings. Actually, it is possible that AI systems may not be able to always give ethically proper and scientifically correct answers. Therefore, a proper understanding of the limitations of AI systems is necessary.

What is presented in this article are proposals to change the stubborn "grammar" of schooling in the age of AI. Grammar is rules of languages. Every language has its grammar. So the efforts to change the grammar of a language are not quite possible. If we want education to follow a different grammar, we need to change the language. That language is personalized learning through identifying and solving problems for others.

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