The Case for Cognicy

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Abstract

This position paper introduces the idea of cognicy, the foundational ability to think and understand in a process that decouples cognitive processes from their tangible outcomes. Generative artificial intelligence (AI) can produce output often nearly indistinguishable from a human product, which presents a problem for educational assessment. Cognicy focuses on the process of thought, which is uniquely human, rather than the output, which can be machine generated. The nearest parallel is numeracy, which decouples the underlying mathematical concept from the task of calculation. Similarly, cognicy seeks to disentangle the essential thought process from the outputs, which now can be easily composed by AI. Cognicy is thus a tool for shifting the way in which higher education views the intersection of generative artificial intelligence, learning, and evaluation. It must be where future frameworks for learning focus. Process must be seen as separate from product so that human skills and learning stay relevant. This paper gives a name to these human-based, AI adjacent skills, creating a shared language to begin larger discussions. As a means of starting the conversation, the paper explores the relationship of cognicy to the concepts of Universal Design for Learning (UDL), metacognition, and AI literacy to show how this emerging framework might be employed.

Keywords: cognicy; generative artificial intelligence; AI literacy; Universal Design for Learning; metacognition; prompt engineering; large language models; future of learning

Introduction

I'm sitting in my friend's kitchen in January 2023 sharing some of my early thoughts about AI in higher education. My friend, who has a background in early childhood education herself, is listening intently. I'm in the nascent stages of developing what will come to be an essential idea for the way we think about AI's influence over learning—the opportunity for us to decouple product from process. "Writing isn't how you think; it's the product of how you think," I say with all of the excitement of a new idea. She stops and looks at me with big eyes. "But how can I think without writing? My brain works like this" (S. Derby, personal communication, January 23, 2023).

She makes a motion like she is in deep thought, tapping her imaginary pen to the side of her head and then moving it down to the table to write furiously on her imaginary paper. It indicates more than just physical writing as a good way to remember thought; it implies an inherent connection between the output of thought (product) and the process of thought. The two are so linked that my friend could not imagine the process of thinking without the product to represent that thinking has been done. What I believe, and am laying out in this paper, is that, as we move into the world of generative AI, it is not just reasonable but even essential to separate process and product. AI brings a new era of productivity that necessitates a new way of thinking about the process of learning that keeps the democratization of product in sight, thereby allowing for thought, not output, to be the main focus. I am calling this ability cognicy.

Simply put, cognicy is the foundational ability to think and understand in a process that decouples cognitive processes from their tangible outcomes. Cognicy requires understanding and judgment not only of your own thought, but also of any potential outputs from large language models and generative AI. As of now, there are still uniquely human skills that are required to work with AI. Cognicy ties together those core abilities, such as assessment, judgment, inspiration, rethinking, and understanding. This is necessary in a post-AI world. Pre-AI, the singular, finished work could be used as evidence of learning. In order to have achieved a product that is acceptable, it logically follows that some thought occurred. Even Bloom's taxonomy allows for higher level learning, such as creation and evaluation, to be judged by a product. If a student, for example, writes a satisfactory term paper, there is the implication that course content was synthesized and utilized. The output being satisfactory implies the thought process was satisfactory. AI removes this clarity. The output being satisfactory no longer implies anything about process, as AI can easily create a product that is passable. With a small amount of prompt engineering, AI can create a product that is good. Educators find this outcome unsettling and destabilizing—muddying the waters. A focus on cognicy seeks to recover clarity in the process, separate from the final product. It is imperative that we take the time to consider the place of cognicy in this developing field. As friction arises between the older and newer modalities, a shared framework and language is needed for understanding the larger conversation. Cognicy is my attempt to help build that shared understanding.

If literacy causes better cognitive outcomes for skills outside of the realm of reading and writing (Vágvölgyi et. al, 2016), then cognicy will likewise show overall improvement, especially

when assessing outcomes of generative AI. Once we see cognicy as the essential element, problems of assessing outcomes will become less fraught. Cognicy can become the foundation upon which we build assignments. Whether that creation is a thought exercise (cognicy for cognicy's sake), a series of engineered prompts, an art piece, or an academic paper, the essential exercise always starts with cognicy. At that point, we are no longer attempting to judge critical thinking through its expression, but rather through the process of having critical thought in the first place.

The Numeracy Parallel

By way of a parallel, let us look at numeracy. Jeffery Craig (2018) places the origins of numeracy as a mid-twentieth century formulation, with the discourse of numeracy increasing in popularity in education through the late twentieth century into the early 2000s. Situating cognicy within this context creates a parallel use-case. Understanding numeracy involves a method of instructing mathematics in order to impart the skill not just of arithmetic, for example, but of a variety of uses in broader contexts (Barwell, 2004; Steen, 1990), including social, cultural, and civic numeracies (Steen, 1990). It is not just numbers that need to be taught, these arguments say, but rather the usage of numbers inside and outside of academic life. This is also how I see the work of understanding and using cognicy. Once we move toward seeing the value of cognicy in different contexts, much like the ones outlined for the teaching of numeracy, we can abandon the fear of AI taking over the product output. Perhaps this is seen nowhere more urgently than the context of understanding the role of cognicy within the world of generative AI.

In her discussion of numeracy, Lynn Arthur Steen (1990) lays out several "don'ts" for teaching numeracy. She writes:

- *Don't teach just arithmetic*. Numeracy requires a rich blend of statistics, geometry, and arithmetic, catalyzed by careful reasoning rooted in common sense.
- *Don't rely on worksheets*. Students learn best in active contexts featuring discussion, writing, debate, investigation, and cooperation. Isolated facts on artificial worksheets reinforce the image of school mathematics as totally artificial, unrelated to real life.
- *Don't ignore calculators*. Children must learn many ways to calculate—manually, mentally, electronically—in realistic contexts that reflect the world around them. Calculators are part of that world and should be part of school mathematics.

- *Don't rely only on school*. Children are influenced as much by the entertainment and sports industries as by formal school instruction. There is much that those industries could do to promote both numeracy and literacy. (p. 229; abbreviated list)

The parallel to the current discussion of AI is striking. Any one of these recommendations could be applied to teaching cognicy with a focus on AI. For example:

- Don’t just grade product. Judging cognicy requires looking at a more holistic idea of learning and mastery that does not rely solely on judging output. The skills of prompting, rewriting, editing, thinking, organizing, and knowing are much more essential to the work of cognicy in an AI world than the outcome of a single, correct answer.
- Don’t rely on AI detectors. Cognicy is best developed when we look at root causes, rather than playing a game of cat-and-mouse with our students. By allowing students to be creative in their use of AI, rather than shutting down essential learning with punitive measures, the instructor gains a window onto cognicy.
- Don’t ignore generative chatbots. Prohibiting them discourages students from developing the crucial cognicy that will help them not just in school and their future work, but likely in their future social and cultural lives as well. AI is here to stay. Students must learn skills to use it.
- Don’t underestimate AI’s present and future capacity. As I write this, AI is developing to include new skills and abilities. By the time you read this, the landscape will have shifted again. A skepticism that focuses on the limits of AI is myopic at best. Developing cognicy allows us to be expansive, rather than reactive, in our own thoughts and understanding of the abilities of AI, both in the present and as we look to the future.

  In her conclusion, Steen states:

  Although we can neither precisely define nor measure numeracy, we can improve it. Especially in an age of computers, we really must take steps to improve the level of numeracy in all segments of society. With numeracy comes increased confidence for individuals to gain control over their lives and their jobs. (1990, p. 229)

Again, “numeracy” can logically be substituted for “cognicy” in this statement. The more we see cognicy as a fundamental skill, a required modality in the way we understand how we are not just teaching but also learning, the more we will be able to understand how we can use generative AI

as one tool to help bring cognicy to our students, preparing them with skills for school, work, and their lives beyond.

While it is all but certain that AI will continue to move forward, it is nearly impossible to know how cognicy will be measured, as process and outcomes are, at this point, deeply linked. We are nowhere near a world in which a simple mind-meld or tiny machine placed on someone's temple would allow a teacher to judge a student's cognicy. While we await that science-fiction future, we can adapt various teaching and learning frameworks, theories, and constructs to understanding cognicy. This paper focuses specifically on Universal Design for Learning (UDL), metacognition, and AI literacy.

Universal Design for Learning

Universal Design for Learning allows for personalized learning as a tool for moving past the accessibility narrative. Rather than making our students ask for accommodation, UDL asks teachers and designers to take away those barriers from the beginning. In this way, learning becomes more equitable, allowing for a wider range of modalities while still making learning feel personalized (*UDL: The UDL Guidelines*, n.d.). Cognicy fits in perfectly with this line of thinking. The multiple means outlined in UDL (*UDL: The UDL Guidelines*, n.d.) work as a functional way of decoupling process from product. UDL forces those using it to think about the differing ways that knowledge can be taught, learned, and expressed. This is inherently the work of teaching cognicy. When we allow students more than one way to show understanding and mastery, then we are showing them that the value of learning is the cognitive process itself, rather than the ability to give a single correct answer. Cognicy, coupled with UDL, allows us to value the knowledge students already bring, as well as the knowledge they gain through the process of learning, in an accessible and equitable format.

Metacognition

In context of AI, it seems reasonable that metacognition will become an essential skill for our students to succeed. Metacognition is loosely defined as the ability to think about and understand one's own learning process. The process of learning metacognition involves reflection on one's own ability to think, process, and know (Schmitt & Newby, 1986). The separation of knowing and outcomes of knowing is deeply embedded in the process of cognicy. Once we are judging the process as separate from the product, we are focusing on metacognitive skills (Magno,

2010). Cognicy encourages the development of metacognitive skills, as it requires students to reflect on and regulate one's own thinking processes (Parkes & Kajder, 2010).

In relation to AI, metacognitive skills that allow for cognicy become even more essential. While students can use generative AI to produce answers passively, thereby bypassing thought, cognicy shifts the student's focus onto how to get the AI to output passable information, as well as how to co-create with AI (Epstein, 2015). That level of forcing students to actively engage in their own thought processes is both metacognition and cognicy in action.

AI Literacy

As artificial intelligence has proliferated into larger cultural consciousness, so has the need for the general population to understand what AI is and how it's used. The widespread availability of generative AI makes this need even more pressing. AI literacy is a newer literacy that builds on general digital literacy (Long & Magerko, 2020; Kong et al., 2021). While there are varied paths to gain AI literacy, the overall project of AI literacy seeks to inform learners about AI while teaching them how to evaluate AI, as well as how to problem solve and use artificial intelligence within multiple contexts (Long & Magerko, 2020; Kong et al., 2021; Ng et al., 2021; Southworth et al., 2023).

Cognicy speaks to the metacognitive abilities required for AI literacy. Basic concepts in AI literacy overlap inextricably with cognicy. The practice of using AI responsibly, ethically, and with a larger contextual understanding of the hows and whys of generative AI sits at the core of AI literacy (Long & Magerko, 2020; Kong et al., 2021; Ng et al., 2021; Southworth et al., 2023). As students use AI responsibly, they are forced to use metacognition to think about the ways in which they are prompting, editing, exercising judgment, evaluating, and thinking (Ojeda-Ramirez et al., 2023). Whether they know it or not, this is cognicy. Because AI literacy requires an understanding that encompasses both practice and theory, it requires cognicy. Cognicy must be developed in conjunction with AI literacy and learning.

Beyond the essential skills of using and understanding AI, a focus on cognicy allows us to reimagine the way in which we think about our own process. Cognicy can also help us use the project of developing and spreading AI literacy to examine the efficacy of that learning. In this way, cognicy is a parent skill that is already being taught through the teaching of AI literacy, and of digital literacy overall. Our conception of cognicy could not exist without the preexisting work

on AI literacy to help guide what we are teaching, thereby allowing us to look for the building blocks and commonalities of thought.

New Skills for a New Era

In looking at the project of developing and teaching cognicy, some may say that cognicy sounds a lot like critical thinking skills that are already being taught. Cognicy and critical thinking certainly do have many commonalities. However, cognicy uses critical thinking through a lens that understands that new modalities and new technology necessitate a new view with an acute awareness of generative AI. The critical thinking that goes into cognicy allows us to look at the differentiated parts of the process (pre-, during, and post-), rather than the singular finished work implying that the process must have been followed.

Just as there are skills that can help develop critical thought, we will need skill sets that are specific to the work of developing cognicy. These distinct and developing skills are why we must look at cognicy as a separate project. For example, the idea of prompt engineering is a particular type of cognicy that speaks to critical thinking skills *and* to the specific project of generative AI. Similarly, editing, long a core skill in critical thinking, must be re-learned and re-imagined when combined with prompt engineered input and generative AI output. Cognicy allows us to see the individual parts of the whole, critically examining each step of our own thought process outside of our product output. The specific type of critical inquiry created by having cognicy helps us see an interconnected series of processes as the product, rather than the end-work.

It is likely that there will be resistance to the adoption of cognicy, just as there is concern about the uses of AI in higher education overall. (Chávez et al., 2023; Cotton et al., 2023; Perkins, 2023; Sullivan et al., 2023). Faculty may be worried that acknowledging and allowing the use of AI, especially with regard to thinking of cognicy as a core skill, invites trouble. Already, there are calls to go back to in-person assessments and oral examinations (Lem, 2023; Newell, 2023). This must not be the way forward. Ignoring the advancement of AI will not stop it within higher education and outside of it. It seems imperative that we find a way to reconfigure our modes and thinking to encompass this new era. Cognicy is a way that education can keep quality of thought while allowing for new ways of showing us that students are thinking.

Conclusion

It seems reasonable to admit that students are using generative AI in small ways we can guess and in imaginative ways we're unlikely to ever notice (Terry, 2023). I am, of course, far from the only person to notice that while AI is unlikely to disappear from our schools and society, it also provides an opportunity for an expanded view of how we are teaching, thinking, and learning (Sobo, 2023; Young, 2023; Fister & Head, 2023; McMurtrie, 2022; Darby, 2023). Looking at these advancements through the lens of cognicy brings a framework to the disparate pieces of the larger conversation about AI in higher education.

In a world where end results can easily be generated by AI, the only way forward is to explore and assess the process of thought. Cognicy is a way to understand that thought process, especially as it pertains to the steps required to use AI. Numeracy provides a useful parallel for how to go about rethinking and reframing for this shift. Much as numeracy requires an understanding of numbers rather than an understanding of arithmetic tasks, cognicy requires an exploration and understanding of thought rather than the product of that thought. In many ways, frameworks and tools already exist to help us understand how to view cognicy. Using Universal Design for Learning (UDL) gives us a way to explore equitable alternatives to traditional assessment. Metacognition gives students a way to think about their own learning as part of the learning itself. Moreover, the project of increasing AI literacy must sit hand-in-hand with increasing cognicy, as AI literacy requires a metacognitive as well as practical understanding of the process of using AI. Despite any initial resistance, ultimately there isn't a choice when it comes to using AI. The AI revolution in higher education has happened. We must shift with it in more ways than small changes. We must rethink our own thinking.

I will end by noting that while I did not use generative AI to help me with the product of this paper, through brainstorming or co-writing actual words that have made it onto this page, I have no doubt that I could have done so. I could have prompted, edited, and reworked anything a decent large-language model would have given me. Because the thoughts are mine, I would have used the same level of cognicy as I've used in writing what you've just read. That, I believe, is an ability worthy of future exploration and development.

References

Barwell, R. (2004). What is numeracy? *For the Learning of Mathematics*, *24*(1), 20–22. http://www.jstor.org/stable/40248441

Chávez, C. M. R., Troya, A. L. C., Cordero, C. R. Z., Orellana, L. M. G., Tapia, R. D. C., Aguila, O. E. P., . . . Gonzáles, J. L. A. (2023). Impact of artificial intelligence in promoting academic integrity in education: A systematic review. *Journal of Namibian Studies: History Politics Culture*, *33*, 71–85.

Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, *61*(2), 228–239. https://doi.org/10.1080/14703297.2023.2190148

Craig, J. (2018). The promises of numeracy. *Educational Studies in Mathematics*, *99*(1), 57–71. http://www.jstor.org/stable/45185505

Darby, F. (2023, June 27). 4 steps to help you plan for ChatGPT in your classroom. *The Chronicle of Higher Education*. https://www.chronicle.com/article/4-steps-to-help-you-plan-for-chatgpt-in-your-classroom

Epstein, S. L. (2015). Wanted: Collaborative intelligence. *Artificial Intelligence*, *221*, 36–45. https://doi.org/10.1016/j.artint.2014.12.006

Fister, B., & Head, A. J. (2023, May 4). Getting a Grip on ChatGPT. *Inside Higher Ed*. https://www.insidehighered.com/opinion/views/2023/05/04/getting-grip-chatgpt

Kong, S. C., Cheung, W. M., & Zhang, G. (2021). Evaluation of an artificial intelligence literacy course for university students with diverse study backgrounds. *Computers & Education: Artificial Intelligence*, *2*, Article 100026. https://doi.org/10.1016/j.caeai.2021.100026

Lem, P. (2023, August 17), Majority of students cheat in online exams – study. *Times Higher Education*, https://www.timeshighereducation.com/news/majority-students-cheat-online-exams-study

Long, D., & Magerko, B. (2020). What is AI literacy? Competencies and design considerations. *CHI '20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems,* 1–16. Association for Computing Machinery. https://doi.org/10.1145/3313831.3376727

Magno, C. (2010). The role of metacognitive skills in developing critical thinking. *Metacognition and Learning*, *5*(2), 137–156. https://doi.org/10.1007/s11409-010-9054-4

McMurtrie, B. (2022, December 13). AI and the future of undergraduate writing. *The Chronicle of Higher Education*. https://www.chronicle.com/article/ai-and-the-future-of-undergraduate-writing

Newell, S. J. (2023). Employing the interactive oral to mitigate threats to academic integrity from ChatGPT. *Scholarship of Teaching and Learning in Psychology*. Advance online publication. https://doi.org/10.1037/stl0000371

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers & Education: Artificial Intelligence*, *2*, Article 100041. https://doi.org/10.1016/j.caeai.2021.100041

Ojeda-Ramirez, S., Rismanchian, S., & Doroudi, S. (2023, August 19). Learning about AI to learn about learning: Artificial intelligence as a tool for metacognitive reflection. *EdArXiv Reprints*. https://doi.org/10.35542/osf.io/64ekv

Parkes, K. A., & Kajder, S. (2010). Eliciting and assessing reflective practice: A case study in Web 2.0 technologies. *The International Journal of Teaching and Learning in Higher Education*, *22*(2), 218–228. http://files.eric.ed.gov/fulltext/EJ930156.pdf

Perkins, M. (2023). Academic integrity considerations of AI Large Language Models in the post-pandemic era: ChatGPT and beyond. *Journal of University Teaching & Learning Practice*, *20*(2). https://doi.org/10.53761/1.20.02.07

Schmitt, M. C., & Newby, T. J. (1986). Metacognition: Relevance to instructional design. *Journal of Instructional Development*, *9*(4), 29–33. http://www.jstor.org/stable/30220831

Sobo, E. (2023). Could ChatGPT prompt a new golden age in higher education? *Teaching and Learning Anthropology*, *6*(1). https://doi.org/10.5070/t36160114

Southworth, J., Migliaccio, K. W., Glover, J., Glover, J., Reed, D., McCarty, C., Brendemuhl, J. H., & Thomas, A. M. (2023). Developing a model for AI across the curriculum: Transforming the higher education landscape via innovation in AI literacy. *Computers & Education: Artificial Intelligence*, *4*, Article 100127. https://doi.org/10.1016/j.caeai.2023.100127

Steen, L. A. (1990). Numeracy. *Daedalus*, *119*(2), 211–231. http://www.jstor.org/stable/20025307

Sullivan, M., Kelly, A., & McLaughlan, P. (2023). ChatGPT in higher education: Considerations for academic integrity and student learning. *Journal of Applied Learning and Teaching*, *6*(1), 31-40. https://doi.org/10.37074/jalt.2023.6.1.17.

Terry, O.K. (2023, May 12). I'm a student. You have no idea how much we're using ChatGPT. *The Chronicle of Higher Education*. https://www.chronicle.com/article/im-a-student-you-have-no-idea-how-much-were-using-chatgpt

UDL: The UDL guidelines. UDL. (n.d.). https://udlguidelines.cast.org/

Vágvölgyi, R., Coldea, A., Dresler, T., Schrader, J., & Nuerk, H. (2016). A review about functional illiteracy: Definition, cognitive, linguistic, and numerical aspects. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.01617

Young, J. (2023, May 11). "Why I'm Excited About ChatGPT". *Inside Higher Ed*. https://www.insidehighered.com/opinion/views/2023/05/11/why-im-excited-about-chatgpt

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