

# Open Debate: Artificial Intelligence and (Human) Learning

## Toward Reciprocal Partnerships between Human and Maschine?

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The Imminence of . . .

# Grading Essays by Computer

Breakthrough? Or buncombe and ballyhoo?

You should know, after reading this careful description of efforts at the University of Connecticut to rescue the conscientious English teacher from his backbreaking burden. It is authored by the researcher whose very first computer strategy for essay grading yielded marks indistinguishable from those of experts. Mr. Page, himself a refugee from English teaching, answers questions that will occur to the skeptical educator.

By ELLIS B. PAGE

[...] What psychometricians really need, it is clear, is some way to **measure essay quality** with the same reliability, validity, and generalizability – with the same “objectivity” – which they enjoy with multiple-choice items. And this measurement need, too, **the computer seems destined to alleviate** [...]

Page, E. B., & Paulus, D. H. (1968). *The analysis of essays by computer. Final report.* Storrs: University of Connecticut.

## INTRODUCTION


If computerized instruction is ever to have a large impact on education, computer-assisted instruction (CAI) systems must have the flexibility and skill of a human teacher. In developing the SCHOLAR CAI system Carbonell (1) took a first step toward an intelligent tutorial CAI system. In SCHOLAR, knowledge was not stored as text, but in an interrelated network of facts and concepts, so that the knowledge could be used in a variety of ways. In short, the attempt was to structure information like a human knowledge, so that the program could use its knowledge as flexibly as a human tutor does.

## Talk to Eliza by typing your questions and answers in the input box.

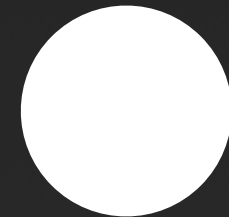
\* I do not feel well.  
> It is nice to be chatting with you.  
\* Can you help me?  
> Is it that you would like to be able to help you?  
\* Certainly yes.  
> I see. Let's explore that a bit more.  
\* Do you have a solution  
> Oh... Let's move on to something else for a bit. have a solution?  
\* You solution to my problem?  
> You're not really talking about me, are you?

TYPE HERE |


Weizenbaum, J. (1983). ELIZA — a computer program for the study of natural language communication between man and machine. *Communications of the ACM*, 26, 23–28. <https://doi.org/10.1145/357980.357991>



Artificial intelligence remains **a sleeping giant** in the educational context.



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Bates, T., Cobo, C., Mariño, O., & Wheeler, S. (2020). Can artificial intelligence transform higher education? *International Journal of Educational Technology in Higher Education*, 17(42), 1–12. <https://doi.org/10.1186/s41239-020-00218-x>



The **potential** for artificial intelligence in education **to become mainstream** is growing.

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Pelletier, K., Robert, J., Muscanell, N., McCormack, M., Reeves, J., Arbino, N., & Grajek, S. (2023). *2023 EDUCAUSE horizon report, teaching and learning edition*. EDUCAUSE.

01

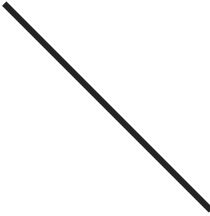
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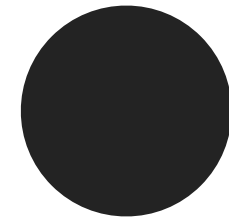
Artificial Intelligence  
in Education -  
quo vadis?

Artificial Intelligence  
in Education -  
status quo?


Artificial Intelligence  
in Education -  
in futuro?



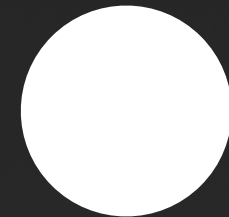
**Artificial intelligence (AI)** refers to the attempt to develop machines that can do things that were previously only possible through human cognition.

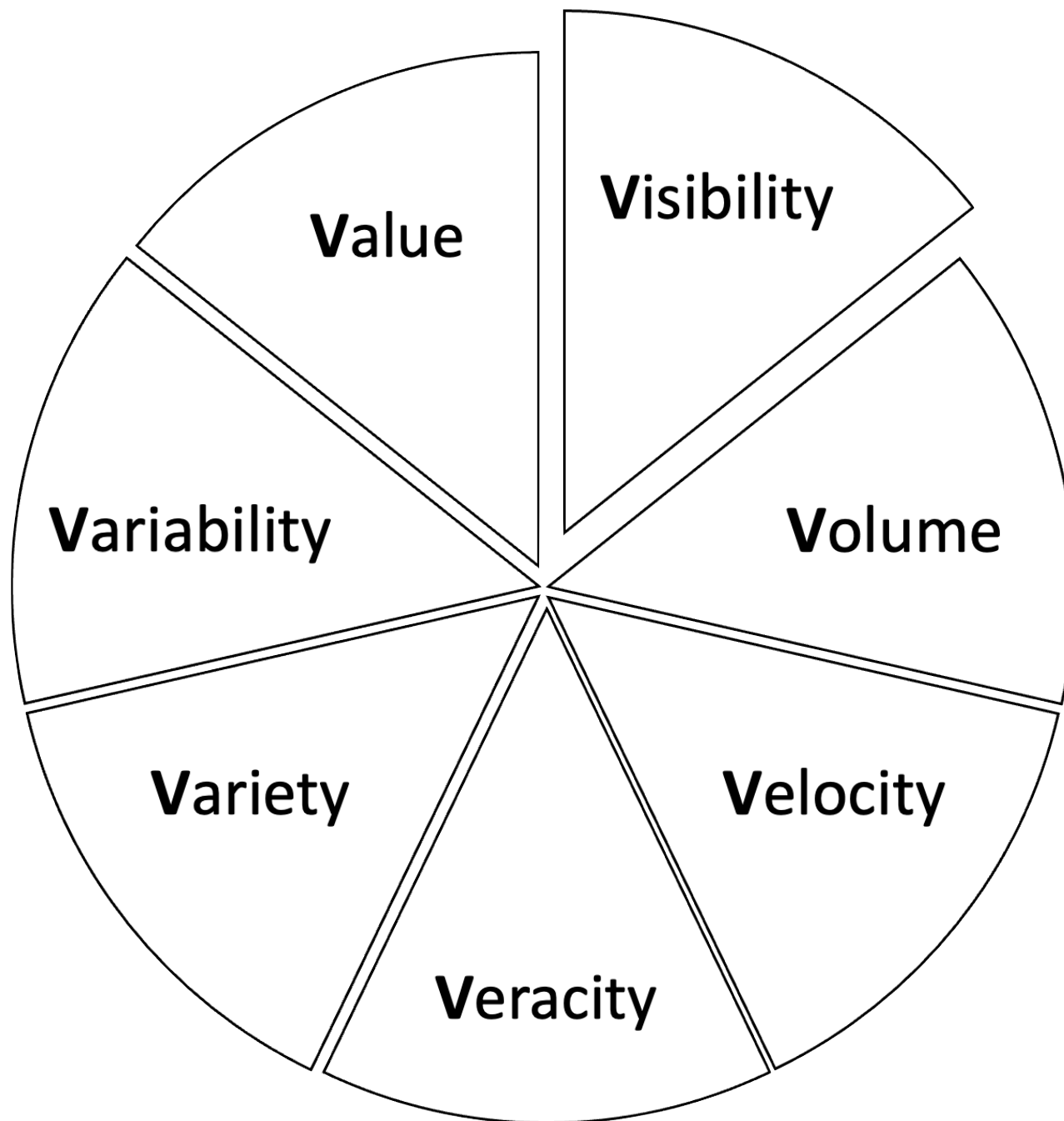




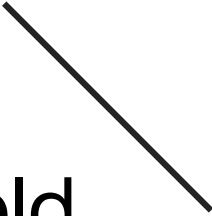


In contrast to humans, AI systems can process a much larger **volume of data in real time.**

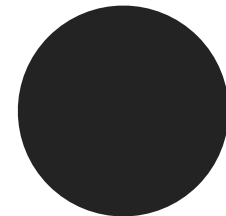
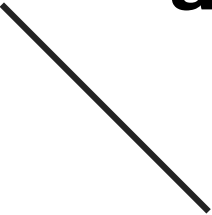


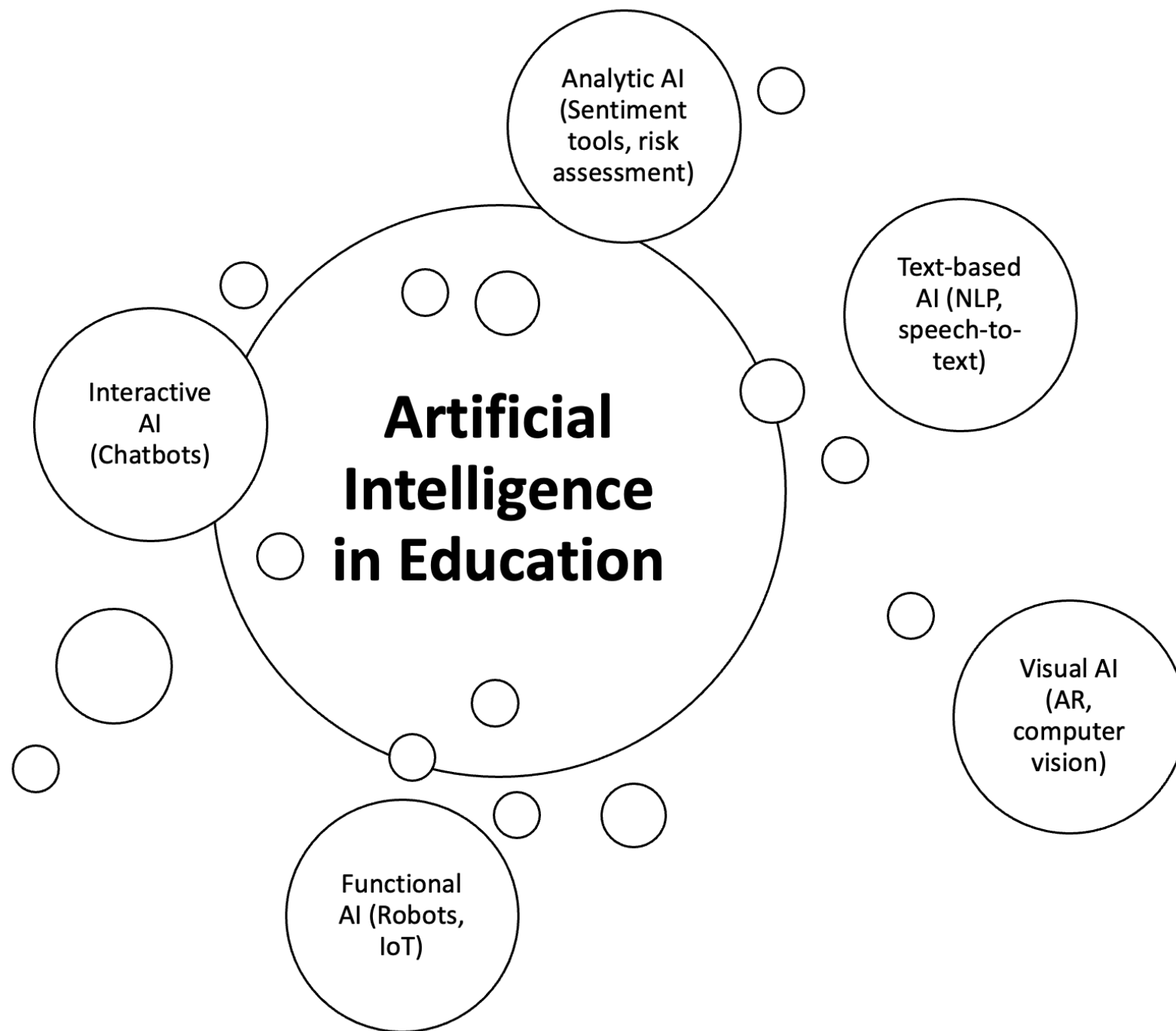


Niculescu, V. (2020). On the impact of high performance computing in big data analytics for medicine. *Applied Medical Informatics*, 42(1), 9–18.  
<https://ami.info.umfcluj.ro/index.php/AMI/article/view/766>




As an interdisciplinary research field,  
**Artificial Intelligence in Education**  
integrates **methods and tools** from  
multiple disciplines, such as computer  
science and information science, **to**  
**address educational problems.**

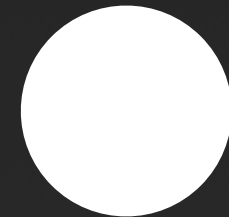


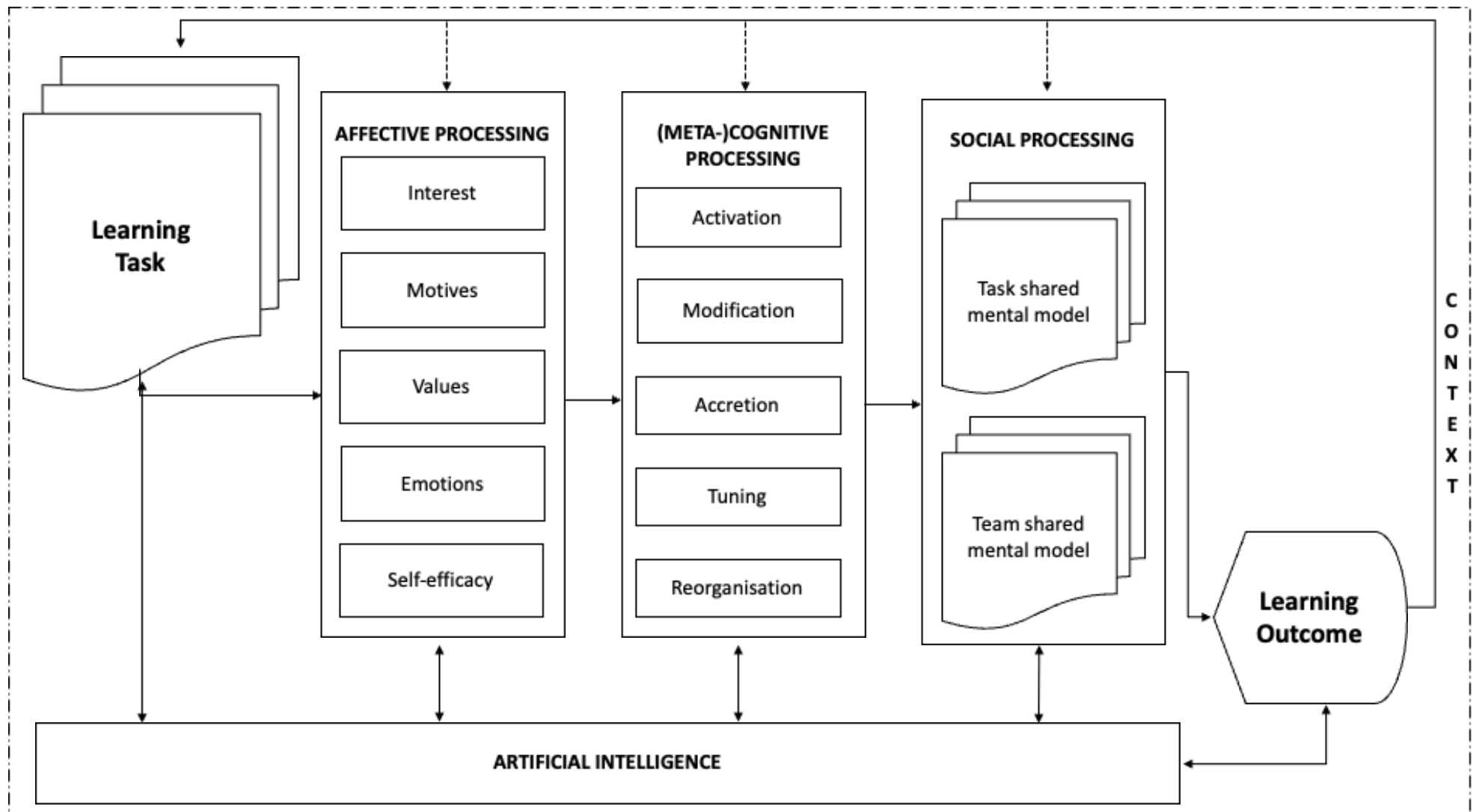


Regona, M., Yigitcanlar, T., Xia, B., & Li, R. Y. M. (2022). Opportunities and adoption challenges of AI in the construction industry: A PRISMA review. *Journal of Open Innovation: Technology, Market, and Complexity*. <https://doi.org/10.3390/joitmc8010045>

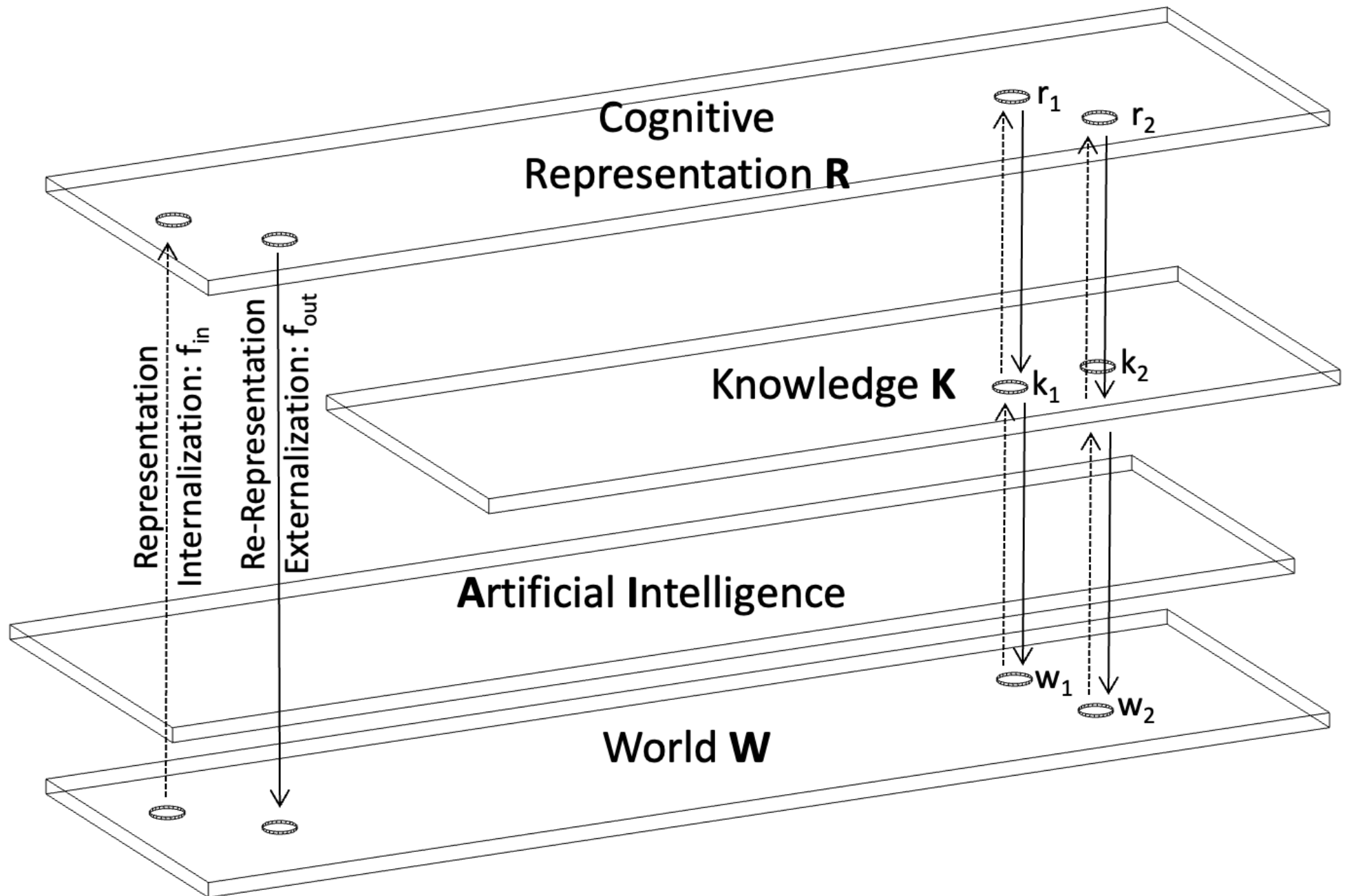


There is a lack of **sound theoretical models** and a **shortage of rigorous empirical evidence** linking artificial intelligence and education.





Joksimovic, S., Ifenthaler, D., De Laat, M., Siemens, G., & Marronne, R. (2023). Opportunities of artificial intelligence for supporting complex problem-solving: findings from a scoping review *Computers & Education: Artificial Intelligence*, 4, 100138. <https://doi.org/10.1016/j.caeai.2023.100138>



Ifenthaler, D. (2010). Scope of graphical indices in educational diagnostics. In D. Ifenthaler, P. Pirnay-Dummer, & N. M. Seel (Eds.), *Computer-based diagnostics and systematic analysis of knowledge* (pp. 213–234). Springer. [https://doi.org/10.1007/978-1-4419-5662-0\\_12](https://doi.org/10.1007/978-1-4419-5662-0_12)

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02

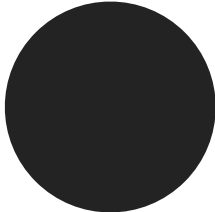
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Artificial Intelligence  
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quo vadis?

Artificial Intelligence  
in Education -  
status quo?

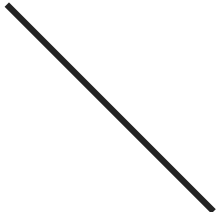
Artificial Intelligence  
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in futuro?






The implementation of **artificial intelligence in education** requires a further development of **systems, processes, and stakeholders.**

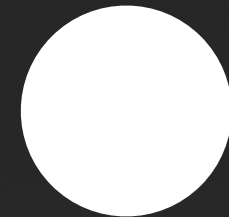
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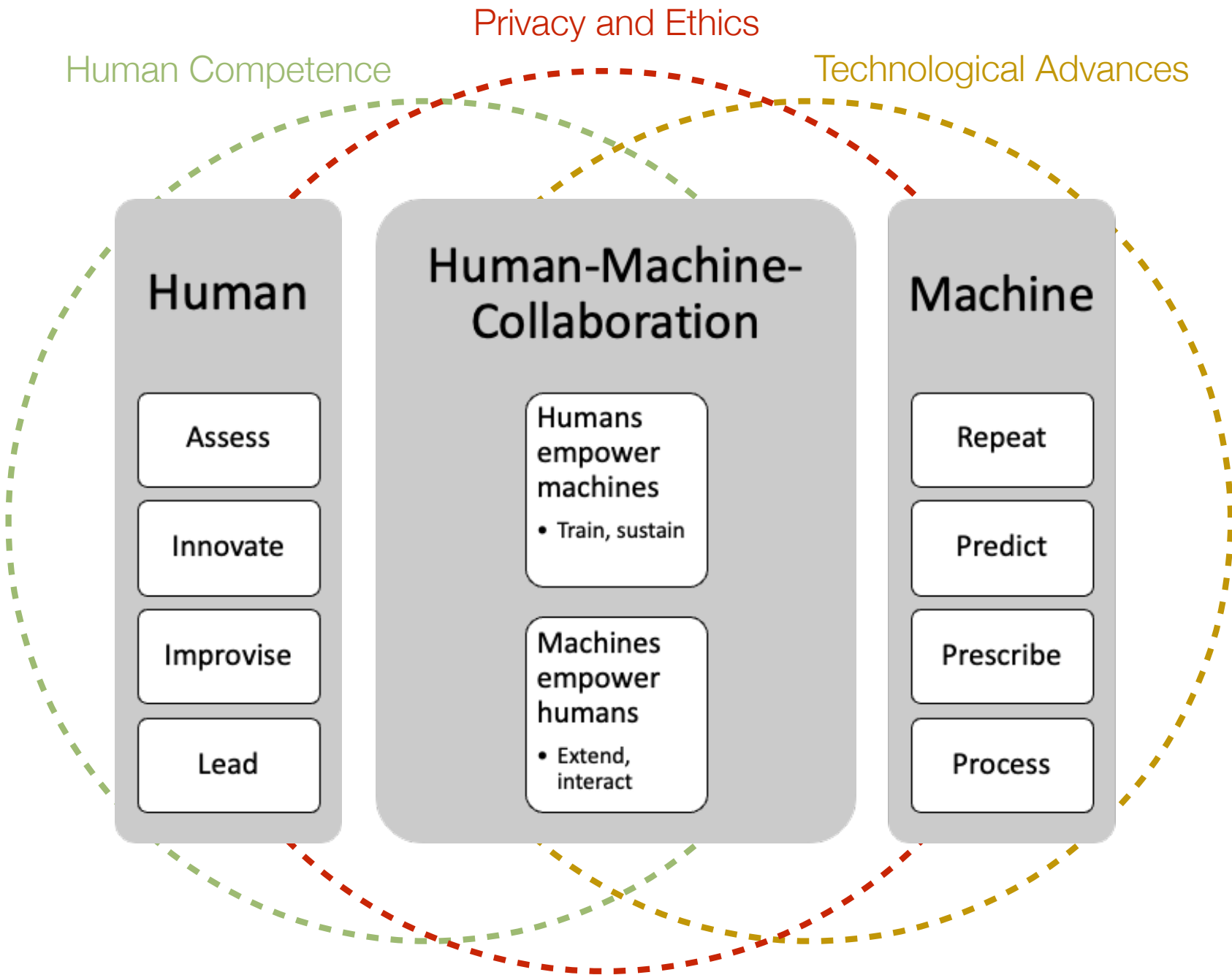


De Laat, M., Joksimovic, S., & Ifenthaler, D. (2020). Artificial intelligence, real-time feedback and workplace learning analytics to support in situ complex problem-solving: a commentary. *International Journal of Information and Learning Technology*, 37(5), 267–277. <https://doi.org/10.1108/IJILT-03-2020-0026>



Artificial intelligence is already being used in the context of higher education **without stakeholders being aware of its content and scope.**





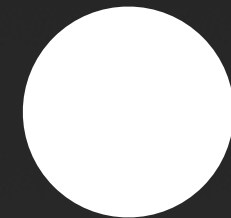
Daugherty, P. R., & Wilson, H. J. (2018). *Human + machine: Reimagining work in the age of AI*. Harvard Business Review Press.



While research findings support the assumption that affective, (meta-)cognitive, and social processes support learning and teaching, **opportunities of AI for supporting education** need to be further investigated.



Joksimovic, S., Ifenthaler, D., De Laat, M., Siemens, G., & Marronne, R. (2023). Opportunities of artificial intelligence for supporting complex problem-solving: findings from a scoping review *Computers & Education: Artificial Intelligence*, 4, 100138. <https://doi.org/10.1016/j.caeai.2023.100138>



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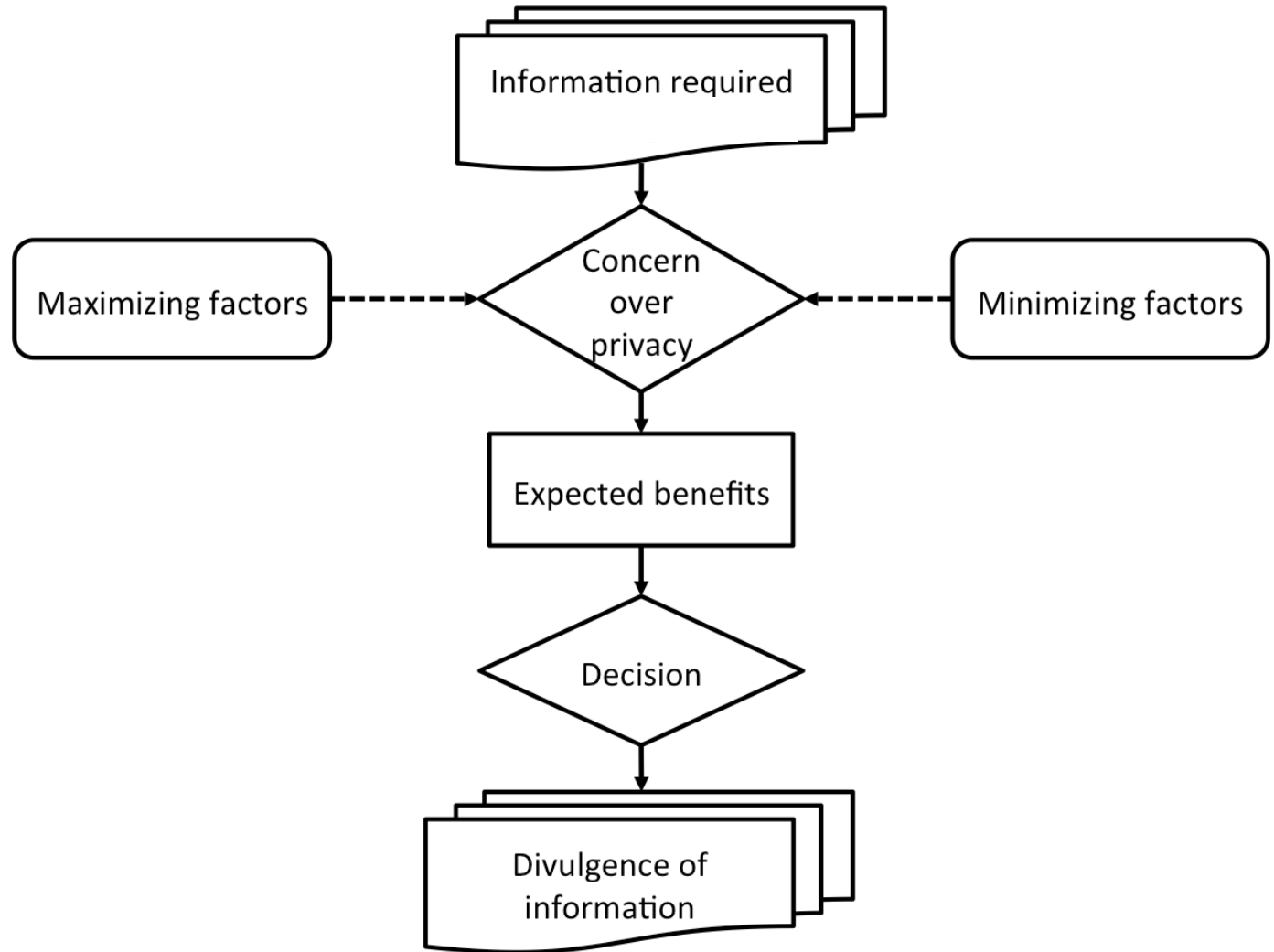
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# 01

## Data Privacy and Ethics.





Algorithmic  
Ethics

Data  
Ethics

Education  
Ethics

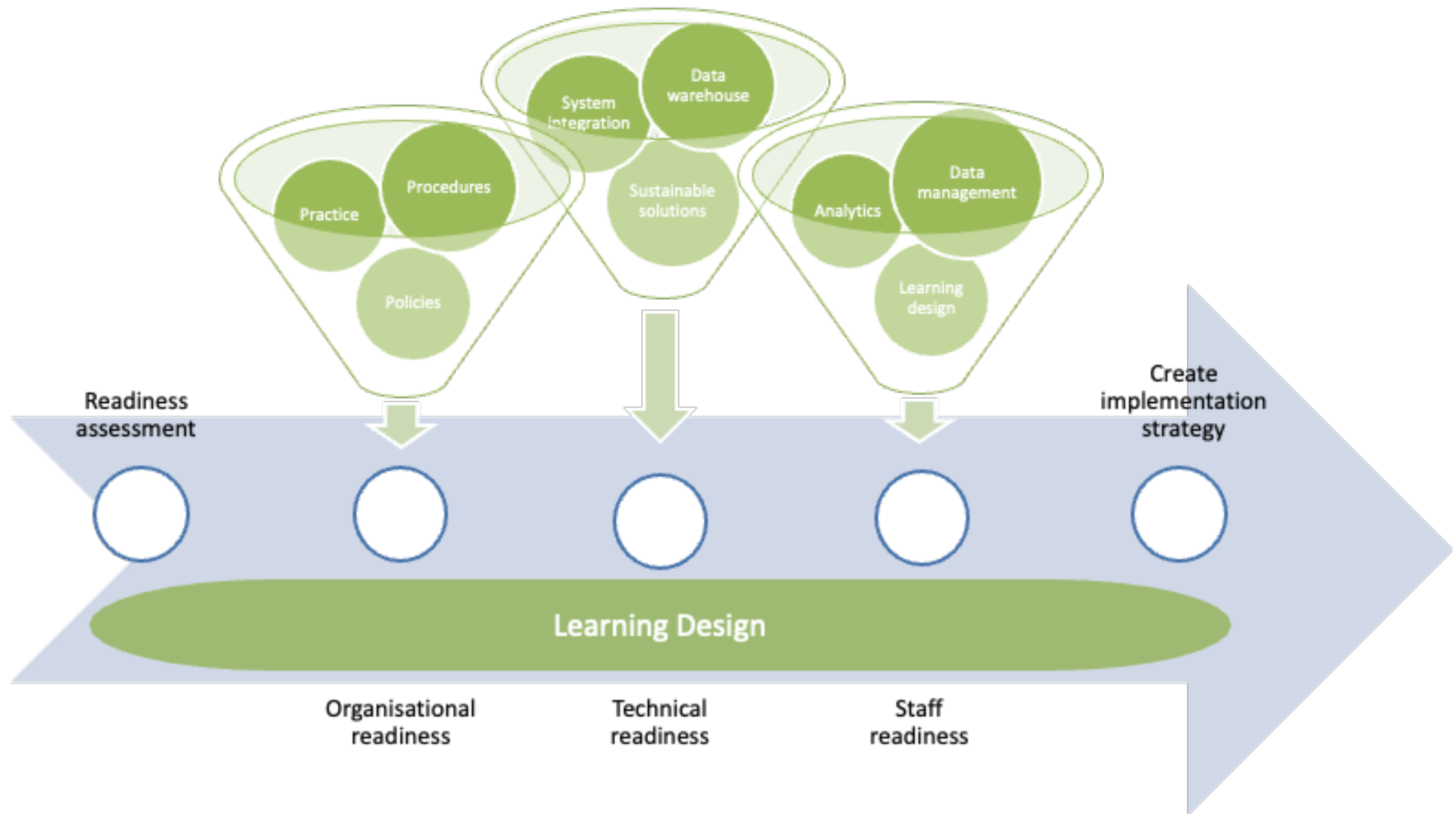
Mutimukwe, C., Viberg, O., Oberg, L.-M., & Cerratto-Pargman, T. (2022). Students' privacy concerns in learning analytics: Model development. *British Journal of Educational Technology*, 53(4), 932–951. <https://doi.org/10.1111/bjet.13234>

To integrate artificial intelligence into educational organisations, actionable frameworks and **adoption models** are required.

# 02

## Artificial Intelligence Onboarding.

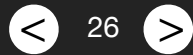




Ifenthaler, D. (2020). Change management for learning analytics. In N. Pinkwart & S. Liu (Eds.), *Artificial intelligence supported educational technologies* (pp. 261–272). Springer. [https://doi.org/10.1007/978-3-030-41099-5\\_15](https://doi.org/10.1007/978-3-030-41099-5_15)

# 03

Data Culture.



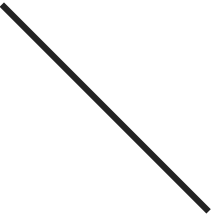
**Data quality** cannot be solved through artificial intelligence.



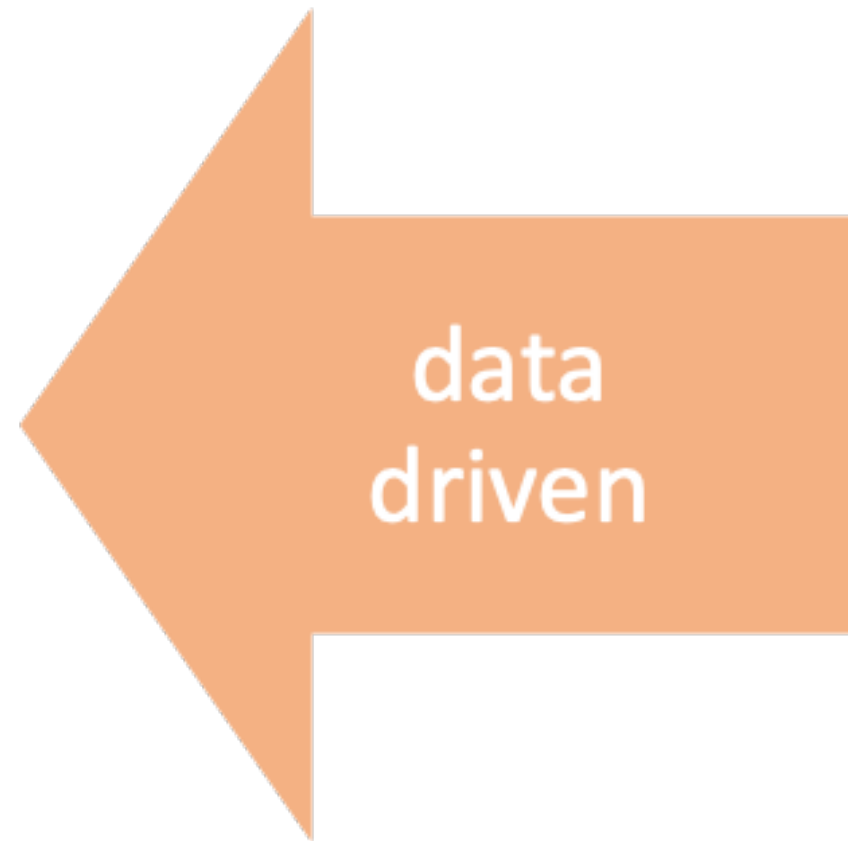
**Valid indicators** for supporting algorithms  
are the **prerequisite for artificial  
intelligence in education.**



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Hemmler, Y. M., Rasch, J., & Ifenthaler, D. (2022). A categorization of workplace learning goals for multi-stakeholder recommender systems: A systematic review. *TechTrends*. <https://doi.org/10.1007/s11528-022-00777-y>

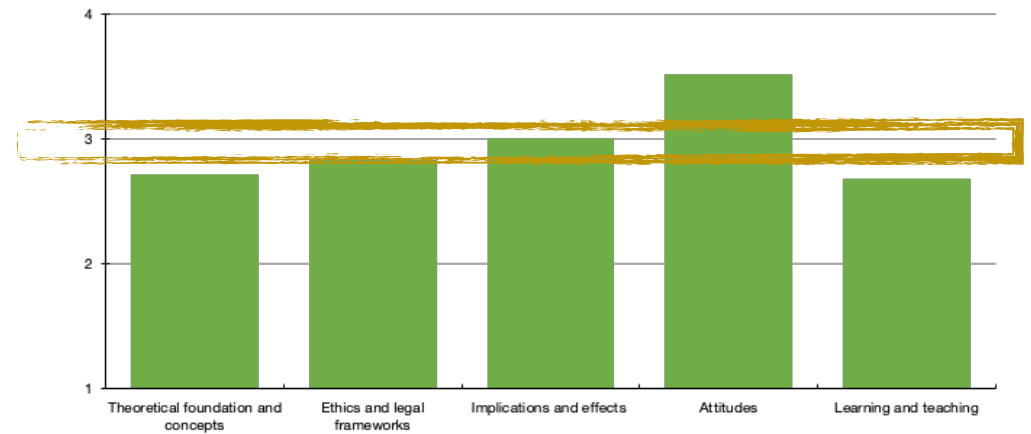
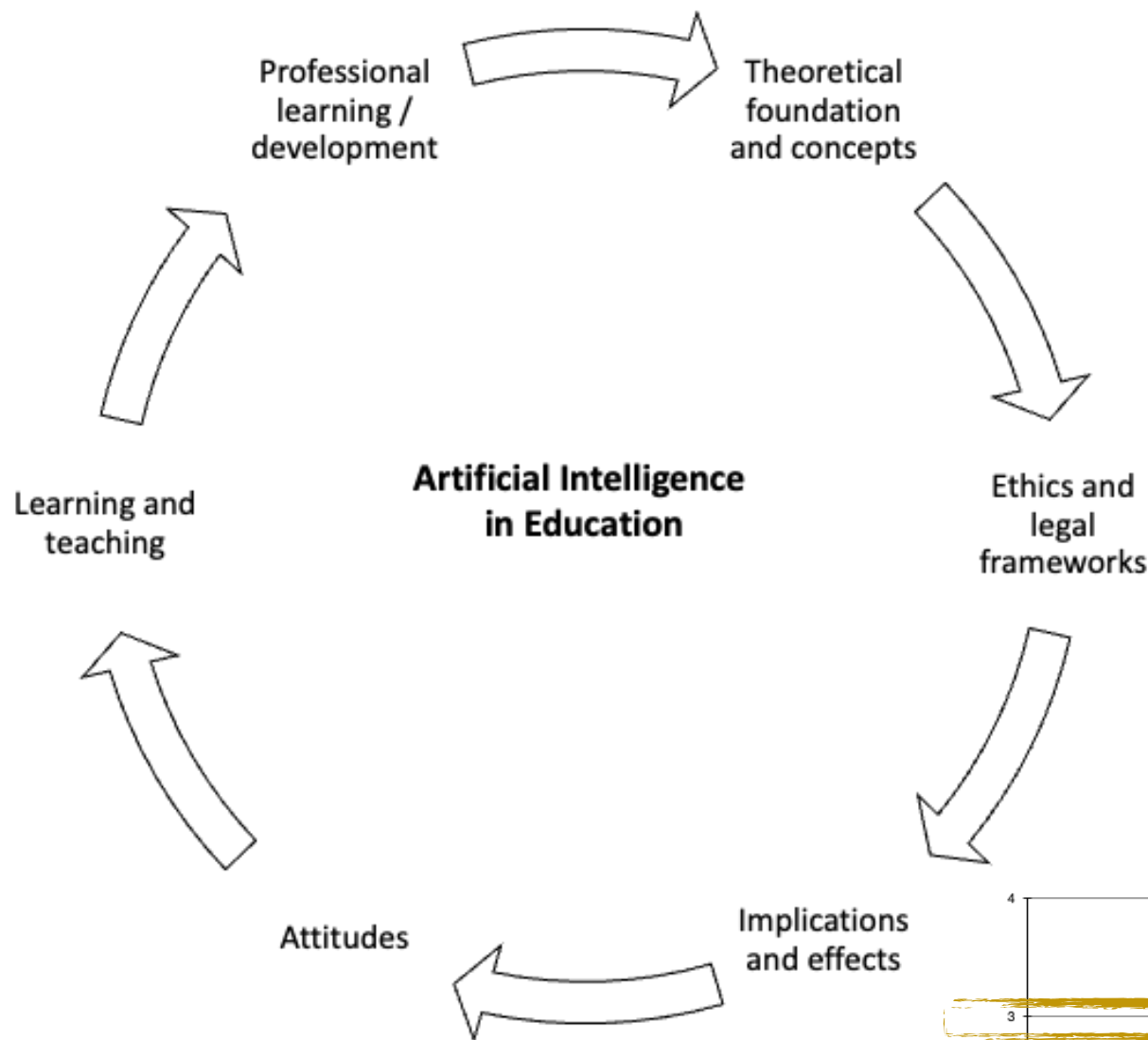


Ifenthaler, D. (2021). Learning analytics for school and system management. In OECD (Ed.), OECD digital education outlook 2021: pushing the frontiers with artificial intelligence, blockchain and robots (pp. 161–172). OECD Publishing. <https://doi.org/10.1787/d535b828-en>

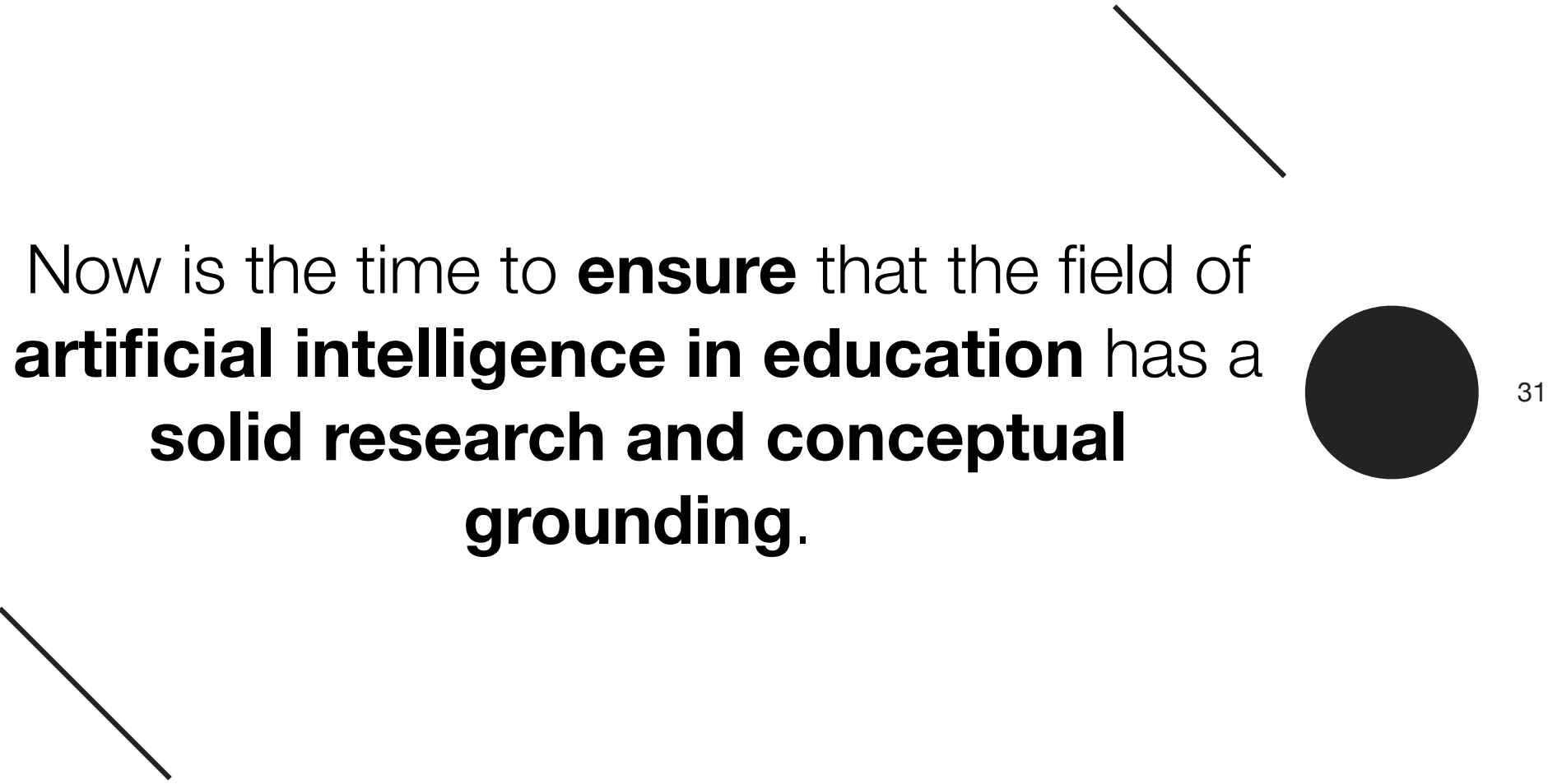
Artificial intelligence (AI) competence in the context of education is a set of skills that enable stakeholders to **ethically and responsibly develop, apply, and evaluate AI** for learning and teaching processes.

# 04

Artificial Intelligence  
Competence.



Delcker, J., Heil, J., Ifenthaler, D., Seufert, S., & Spirgi, L. (2024). First-year students AI-competence as a predictor for intended and de facto use of AI-tools for supporting learning processes in higher education. *International Journal of Educational Technology in Higher Education*, 21, 18. <https://doi.org/10.1186/s41239-024-00452-7>



Now is the time to **ensure** that the field of **artificial intelligence in education** has a **solid research and conceptual grounding.**

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Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., Negrea, V., Oxley, E., Pham, P., Chong, S. W., & Siemens, G. (2024). A meta systematic review of Artificial Intelligence in Higher Education: A call for increased ethics, collaboration, and rigour. *International Journal of Educational Technology in Higher Education*, 21, 4. <https://doi.org/10.1186/s41239-023-00436-z>

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