SURF Npuls

The state of AI and the modern educational institution.

AI explained in the context of the educational sector

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1. Introduction

Every day comes with a new concern or opportunity related to AI. We are constantly asked to rethink our way of working, to take advantage of new tools, to be worried about the impeding revolution of work as we know it, worried about disinformation and the erosion of trust. How can we make sense of this noise? **How can our organizations carve their own routes ahead**, shaping our domains with the help of technology rather than by being subject to it? We need to tackle change with the right urgency, neither hyping possibilities nor underestimating them.

AI has the potential to improve the education of our students, enhance our academic programs and support more efficient administrative processes. However, what this means in practice highly depends on the sector (mbo/hbo/wo) and on the values we bring to the discussion. **But there are multiple paths ahead** and we need to be in the driving seat, so we end up where we want to be. For that, we need to recognize what questions are really being asked of us, at what level and how to approach them.

In this document, you will read about different lenses that can be used to talk about AI and specific impacts it can have on business functions within institutions. AI is more than a technology, so we explicitly point at different readings one can have of certain questions, depending on which assumptions one makes. **This document is designed to provoke discussions and trigger action**, so we conclude with a list of specific questions and needs. In the appendix you will find additional information and recommended reading.

2. Understanding AI

To deal with the technological developments that affects education and research, leadership is needed, with foresight of future developments. To do this well for AI, the impact on all aspects of the sector must be considered. In this section, we describe what AI is and what narratives and assumptions surround it. We do this with the help of several lenses, that can be used to navigate the different perspectives.

These perspectives contain technical elements, but also an understanding of AI as a complex socio-technical system encompassing certain philosophical, ethical, socio-economical, and geo-political dynamics. The key is that AI is not one of those aspects only, but a complex combination of elements with a broader impact than usual technological innovations.

2.1 What is AI?

The WRR frames AI as a “systems technology” (like the steam engine, electricity, and computers), emphasizing both its role as a “general-purpose technology” and its systematic societal impact.[1] This frame allows us to understand and put to words the long-term and pervasive impact of the AI developments.

Figure 1 Five tasks defined by WRR for societal embedding of AI.

[1] Read more in the WRR Report ‘Mission AI’ executive summary in the appendix or english.wrr.nl/publications/reports/2021/11/11/summary-mission-ai

AI has always been difficult to define[2] but stems from a quest for "human intelligence" in machines and goes all the way to the dream of super intelligence. We can at least understand it as *systems that use data in order to generate outputs that fulfill either explicit or implicit objectives.* Those outputs can be used to influence the virtual or physical environment. For this, AI systems use a combination of data, algorithms, and hardware to run them on. It is broader than generative AI like ChatGPT and can be applied to most fields where an objective, either explicit or implicit, can be formulated.

A strength of AI is that by using data and algorithms, we can create systems (programs, applications) we would not know how to code using traditional methods. Think of complex image analysis, systems that play games, or the current large language models. Applications of AI tend to fall into a few categories: optimization, prediction, generation, and classification. Of note is that they all need clear "success criteria" to be designed, are increasingly good at working with all modalities (image, video, text, audio), and successful AI systems integrate and orchestrate multiple models into one system.[3]

The performance of AI systems is notably dependent on the quality and quantity of the data it has been trained on (traceability and legality of the training data is a key question here). In addition, these systems do not exist in isolation. The data labelling and classification of outcomes of models is done by workers across the globe under questionable working conditions. Additionally, these systems are developed and trained on hardware infrastructure, that is physically hosted somewhere and has a significant environmental footprint.

2.2 Broader understanding

As mentioned above, several lenses can be used to talk about AI. Precise definitions are not so relevant, but having a sense of the context surrounding claims or reports will help navigate the conversations. Specific care should be taken to recognize the difference between perceived, communicated, and actual capabilities of AI systems.

You have to understand that AI is deeply anchored in *philosophy,* because its roots lie in theory of the mind. Which means new developments challenge our notions of intelligence, creativity, and what it means to be human. We do not completely understand the full implications of the amazing capabilities of existing systems, but the connection to deeper questions about ourselves leads to discussion whether AI is becoming smarter than humans (superintelligence) and the risks associated with that, questions around agency (can it be an author) and what that means to us humans (and how education relates to that).

Next to this AI has raised new *ethical* questions around bias, decision-making, fairness, and inequality. There are concerns about how AI systems might perpetuate existing biases or create new ones, and debates on how to ensure AI systems make ethical decisions, especially in areas like healthcare, law enforcement, and autonomous vehicles. In both research and education this requires extra care not to discriminate certain groups or individuals, thereby increasing inequity and tensions in society.

AI also has broad *socio-economic* impacts. The S-BB has conducted a trend exploration for the vocational sector, and states that the impact of AI differs largely between professions and sectors.[4] Various consulting firms estimate that generative AI will impact jobs, either replacing or reshaping them (PWC expects 44% of all jobs in the Netherlands, and 74% in education, to have high exposure to AI and an experiment from BCG suggests consultants work significantly more quickly using AI)[5]. This (perceived) impact can lead to fear for our jobs and risks of exclusion of certain groups that can no longer keep up, thereby increasing inequity and tensions in society. It forces us to think about impact and perception of AI in a broader societal context to ensure AI systems contribute to a future that works for all.

In addition, the *geo-political* dynamics surrounding AI are increasing as it is becoming a crucial element in global power distribution. Most AI graduates join the private sector, often one of the already largest players on the market. Similarly, access to compute is dominated by a few entities, leaving development of the technology in the hands of a few. Global nation-state players are heavily in competition around AI, seeing its potential at gaining an economically and militarily competitive edge. This growing dependency on major tech providers is at odds with the broader public values discourse and could be intensified by AI advancements. This shifting balance of power and reliance on technology is pivotal in shaping the future of democracy and international relations.

There are certainly other drivers at play, but we hope this provided some breadth to the perspectives that can be used to talk and think about AI. In discussing the impacts of AI on our institutions, we hope these lenses help your understanding.

[2] See Appendix 1.1 Definitions of AI

[3] See: Appendix 1 Technology mapping

[4] S-BB trend exploration trendrapportage.s-bb.nl/trendverkenningen/kunstmatige-intelligentie/ki-algemeen/?tab=sectoroverstijgende+samenvatting&item=samenvatting

[5] GenAI@Work report PWC pwc.nl/en/insights-and-publications/themes/the-future-of-work/half-of-dutch-jobs-might-be-significantly-changed-by-generative-ai.html & Navigating the Jagged Technological Frontier: Field Experimental Evidence of the Effects of AI on Knowledge Worker Productivity and Quality papers.ssrn.com/sol3/papers.cfm?abstract_id=4573321

3. How does AI impact the institution?

How the modern educational institution is impacted by AI is a question larger than this document, we can't and won't be exhaustive. In this section, we will discuss how AI touches each part of the institution based on the business function in the HORA/MORA: the *institutional steering*, the *primary processes* of research and education, and the *business operations*.[6] For each, we shortly present some examples of how existing business functions are impacted by AI, looking at opportunities as well as the implicit demand for change. Additionally, for each category we wrote[7] a short illustrative scenario depicting a potential impact of the technology within part of the institution. Not intented to sketch a prefered future, but to showcase the complex interplay between AI and the institutional functions. What we make of these impacts will largely be determined by our belief in what role a modern education institution should have.

3.1 Institutional steering and governance

The steering function within institutions is all about giving direction, being accountable, and driving the institution forwards. It includes business functions such as strategy, governance, policymaking, and accountability towards internal and external stakeholders.

Examples of the impact of AI on steering and governance:

- AI, as a disrupting systems technology, raises questions that often cross departmental boundaries. This leads to unclarity in responsibility and associated voids in leadership. The unique time-pressure to address those questions and the potential stakes involved challenge our organisational structures. For example, how should generative AI be used in education?
- Use of generative AI in the writing of visions and strategies in the sector can start to shape future strategy. Generative AI, like ChatGPT, is not neutral but full of values and biases which will find their ways into end products written with the help of the technology, including our own organisational vision and strategy.[8]
- Developments in AI also demand that institutions take control over developments that are predominantly technology-driven, often entering the institution via commercial products and the consumer market.

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[6] Inspired by the HORA and MORA, we have organized the impact of AI on the modern educational institution according to the 'business functions' (see Appendix 1). Herein we identified three overarching categories of activities within the educational institution (steering the organization, the primary processes of research and education, and the operation of the business).

[7] These use cases were ideated by the authors of this paper and then written into stories with the help of generative AI in the form of ChatGPT 4.0. Final editing was done by the authors.

[8] See Appendix 1 Notes on AI for a visualisation of global bias in AI datasets.

Speculative use case: AI use by institutional policy officers
In the strategic policy department, supported by institutional policy and a good understanding of the technology, a team integrates generative AI to enhance their efficiency in developing policy. They decide to use this AI system in drafting policies by processing current relevant trends and research as well as contextual information from their institutional knowledge banks. This aims to streamline their workflow, allowing the team more time to discuss the policy internally. Thanks to clear policy and sufficient AI-literacy, the team is vigilant of the AI's inherent biases and values, ensuring a critical evaluation of its suggestions. They balance AI's efficiency with human oversight to maintain an ethical, inclusive approach. This case illustrates the potential of AI in policymaking, emphasizing the importance of human judgment in final decision-making processes.

AI is not going away, so it becomes important to understand what AI asks of the steering function as well as how it impacts activities within that function. In such a fast-paced and hype-prone field, it is paramount that leadership creates clarity and direction to make conscious choices going forward and steer the sector in a favourable way.

3.2 Primary processes: education

Most prominently since the launch of ChatGPT has been the conversation about the impact on education. However, the role of AI in education is not limited to generative AI. The Council of Europe recognises four different ways AI interacts with education: learning with AI, using AI to learn about learning, learning about AI, and preparing for AI.[9]

Examples of the impact of AI on education:

- AI impacts the expectations and requirements of education (learning about AI & preparing for AI). There is a growing societal demand for broader AI literacy or AI wisdom (WRR) in which education has an important role. Next to this, AI changes the professional fields which creates new needs and expectations of future employees.[10] Which elements of these societal demand we see as the duty of educational institutions and how can the educational system adjust its education to align with social and labour market needs is a crucial question and requires a holistic approach across all educational levels.
- AI also impacts how we are currently organising education. We have seen that impact most saliently with ChatGPT use by students. This disrupts elements of summative examination (questioning the validity of exams) and challenges the relationships between teachers, students, and exam boards. Do we focus on fraud detection (a losing cat and mouse game), or do we adapt our educational concepts to integrate this new systems technology?

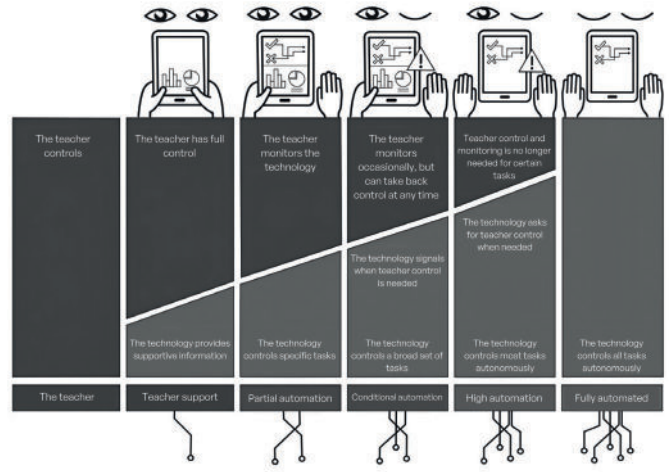


Figure 2 The automation of personalised learning model by Horvers and Molenaar.

- There are also new possibilities with using AI in education (learning with AI). Education institutions are experimenting with automated feedback tools[11] and automated scoring systems[12]. And there are growing possibilities to generate educational content using AI.[13] The extend of the impact can differ across varied amounts of automation by (AI-based) learning technologies in education. This brings with it direct questions about what responsibility and ownership institutions have over the use of AI within their education.
- With increasing use of data-driven applications within education, it becomes an important question to consider who is now learning about learning (the educational research, the teachers, or the developers of new data-driven educational tools)? And what does that mean for the quality of education in the future?

[9] Holmes, W., Persson, J., Chounta, I. A., Wasson, B., & Dimitrova, V. (2022). *Artificial intelligence and education: A critical view through the lens of human rights, democracy and the rule of law*. Council of Europe.

[10] See S-BB trendreport AI which find that there is a large impact by AI on the needed skills and capacities of future graduates in the vocational sector.

[11] Erasmus University Rotterdam has co-developed an automated feedback application with FeedbackFruits. See: eur.nl/en/news/artificial-intelligence-tool-eur-rotterdam-university-applied-sciences-wins-education-oscar

[12] Perusall used by the University of Groningen calculates automatic scores for annotations based on machine learning algorithms. See: edusupport.rug.nl/1988690107

[13] See (e.g.): lessonup.com/site/nl

- For various educational support functions, we can expect (AI-based) applications promising efficiency or improvement. Ranging from planning and rostering, student recruitment and enrolment, and counselling and well-being of students.

Speculative use case: up-to-date and relevant lessons in vocational schooling
A vocational school decides to use a generative AI tool that can process existing materials like reports, videos, and papers to create current and relevant learning materials, quizzes, and lesson plans. Teachers can use this AI capability to adapt their curriculum to the new industry developments. They hope that updating learning materials ensures that students receive up-to-date, practical knowledge aligned with future job market trends. For students, this can translate to more engaging and relevant education, closely mirroring real-world scenarios. However, the board recognizes the importance of ensuring the AI-generated content's accuracy and relevance, addressing ethical concerns around data use and new skills for teachers. Balancing the AI's functionalities with the teachers' expertise and autonomy is crucial to provide quality, context-aware vocational education that leaves enough room for focus on student socialisation and subjectification (next to qualification).

Speculative use case: AI helps increase student's learning skills through self-regulation
Educational institutions build their own AI-powered intelligent tutoring systems that analyze student and study data to enhance self-regulated learning. This intelligent tutoring system adaptively scaffolds educational content, creating a more personalized and effective learning experience. The pedagogical focus lies with self-regulated learning, where the system helps students identify their learning patterns, strengths, and areas needing improvement, empowering students to become more autonomous learners, thereby boosting their self-efficacy. While the system increases educational efficiency and student autonomy, it also poses challenges in data privacy and the potential over-reliance on technology for learning. By building and implementing the system themselves, the educational institution is able to place ethical data use and maintaining a human element in education as central to the system.

AI challenges the educational vision of institutions on every level and asks critical questions that need to be addressed proactively in order to avoid having market forces decide for us. To what extend does the increased use of AI by students and educators require redesign of educational programs: on content level (what are we teaching) and process level (how do we organise assessment and teaching)? The answer to these questions will probably be different for different forms of education.

3.3 Primary processes: research

The impact of AI on research activities is broad and fragmented. Research activities are very diverse and often include cross-departmental, inter-institutional, and international collaborations, which makes it a domain that is difficult to steer.

Examples of the impact of AI on research:

- AI has a strong track-record as a methodology for science, leading to new discoveries or more effective research practices.[14] This new potential also exacerbates the increasing digital divide between researchers who have access to advanced expertise, the necessary data, and compute infrastructure and those that do not.
- AI is increasingly used to navigate the research process itself (e.g., Zeta Alpha, Elicit).[15] The explosion in academic writing volumes and the inherent multi-disciplinarity of some fields make it almost impossible to keep track of academic publishing by hand. Using AI assistants to navigate information may become the new norm quickly.
- Similarly to education, generative AI raises questions around authorship and reproducibility. Discussions around AI writing policies for academic journals differing between prohibitions, whether to allow including AI systems as co-author, or demanding declarations of use in the acknowledgements.[16]
- Increased use of AI and its potential impacts how we do science. Leading to questions what the 'scientific method' looks like, and who takes ownership of that discussion. What constitutes new "knowledge" when using black-box models?

[14] 'Artificial Intelligence and the future of science'. OECD oecd.ai/en/wonk/ai-future-of-science; Van Leeuwen, et al. (2020) Deep-learning enhancement of large scale numerical simulations, March 2020, SURF (link); 'GPUs for research', SURF, video (link);)

[15] See, e.g. Elicit, an AI research assistant that helps with literature reviews: libguides.library.arizona.edu/ai-researchers/elicit

[16] Perkins, M., & Roe, J. (2023). Academic publisher guidelines on AI usage: A ChatGPT supported thematic analysis (12:1398). F1000Research. doi.org/10.12688/f1000research.142411.1

Speculative use case: AI-enhanced literature reviews
Scientists have access to AI and machine learning tools, particularly language-based models, to navigate the extensive and complex academic literature of their fields. These tools offer advanced capabilities like summarization, content extraction, and sophisticated search functions, which promises those researchers to efficiently sift through vast amounts of data and publications. Scientists hope this technology aids them in staying abreast of the latest developments in their fields, leading to more informed and innovative research and helping them keep their competitive edge. However, this pressure to stay competitive and the challenges of AI systems with accuracy, transparency and context-appropriateness of AI-generated summaries and analyses can also lead to less trustworthy science. Balancing AI's convenience with critical human analysis is essential to maintain the integrity and depth of scientific inquiry.

If we see authorship and truth as being two main aspects of science, we can see the existential questions arise with these technologies that are increasingly present in doing science and creating knowledge. We need to address the question of what public scientific system we need.

3.4 Business operations

Educational institutions are complex organisations to run. A wide range of business functions relate to the secondary process of organisational support. Since these business functions are often shared with other kinds of organisations, we can expect a lot of market solutions based on AI (bringing additional challenges in procurement and compliance).

Examples of impact of AI on business operations:

- For each of the business operation units, we can expect impact of AI through new possibilities such as Copilot like applications or other entirely new systems helping to optimize or organize information flows. Decisions about the application landscape will need to be made.
- Demands from the organisation for AI applications will lead to new impacts, e.g.:
  - New compliance requirements come with the use of AI, both via existing legislation (e.g. GDPR) as well as the new AI-act (which could arguably become heavier than GDPR).[17]
  - Demands for new AI products will bring procurement challenges. In fully understanding these new technologies and understanding what it means to comply to regulation and existing institutional policies. Additionally, the increased interest and use by staff might not always reach institutional procurement, leading to an increase of shadow-IT with associated risks.[18]

[17] More info, see De AI act in vogelvlucht on SURF communities
[18] More info, see Shadow ICT in onderwijs en onderzoek on SURF communities

- AI brings with it considerable (and opaque) environmental costs, from building the hardware, training the model, to actual deployment. Adding to the already challenging domain of corporate social responsibility and sustainability.
- Preparing the own staff for the impact of AI is crucial for a consistent response to developments. How do we drive AI literacy of teachers, researchers, staff, and students?

Speculative use case: Improved access to information in institutional knowledge bases
An educational institution adopts AI-driven foundation models to enhance access to its internal knowledge base and intranet, both for internal and external stakeholders. This initiative, a collaboration between the IT innovation, Information Management (IM), and procurement teams, involves a locally hosted AI solution, striking a balance between functionalities and a commitment to public values by the institution. Employees now experience streamlined access to institutional information, aiding in improved decision-making and collaboration. The adoption of this system has led to a significant time saving for finding information, and re-established the knowledge base as an important source of institutional information. However, challenges include managing the accuracy of AI responses and establishing robust guidelines to mitigate potential misinformation. The product owners focus on continuous monitoring and updating of the AI system to maintain its effectiveness and reliability.

In all of this, AI challenges how we organise our organisations. Every part of the business operations will be impacted by either new potential possibilities, or new demands from use of AI technologies elsewhere in the organisation.

As we have seen in these sections, AI impacts all business functions of the institution. Reaping the benefits the technology has to offer, while doing so in a responsible and directed way, requires a large time investment and a diverse knowledge group. How to remain flexible enough to respond to change while rigid enough to keep a consistent direction is a key question to be addressed by institutions. Questions like these we will discuss in the final section of this report.

4. And now?

The worry about the impact of and dependency on technology is not new, as can be seen by the call to action by the Dutch University rectors in 2019.[19] However, the current impact of AI has highlighted the need for a more deliberate response. It is clear AI is not just a hype, but it is also not all it is hyped up to be. Still, AI challenges the whole organisation both existentially (why are we here, and what should we do?) as well as practically (how do we organise responsibility and flexibility?). In section 4.2 we will describe four concrete needs (for vision, action, collaboration, and AI-literacy), which can guide practical next steps and activities. However, to assume that solving those needs would be enough means missing some of the strategic questions that AI as a systems technology raises. Those questions, for which we have no clear answers, we present below in section 4.1 to emphasize the systematic impact of these technologies.

4.1 Big questions we cannot ignore

Based on the research and input gathered for this document, we have formulated 7 strategic questions that institutions, Npuls, SURF and other stakeholders need to think about when it comes to AI in our sector. These can be existential in nature and are meant to stimulate thought and discussion. The discussion around these questions, will give shape to the way we interpret what activities are necessary to fulfil the needs formulated below.

1. For what roles do our (public) institutions exist? How does the growing prevalence of AI impact those roles and what is our preferred role in a future with AI?
2. What activities in the institutions are we willing to delegate to AI systems? What is the implication of this answer on the autonomy of the sector? Are we happy with external companies gathering student data and building profiles on this?
3. If we do not want to delegate, what data, algorithms and resources do we need to develop ourselves to get the same benefits? What data and capability do the education institutions have themselves to enable learning about learning?
4. How do we evolve current organisational structure to respond to the type and pace of questions coming from a fast-moving technological landscape? What kind of culture change enables this change? How to navigate the scope between a compliance-driven control mindset and a foresight-driven strategic one?

[19] “Digitalisering bedreigt onze universiteit. Het is tijd om een grens te trekken,” de Volkskrant, December 22, 2019, volkskrant.nl/columns-opinie/digitalisering-bedreigt-onze-universiteit-het-is-tijd-om-een-grens-te-trekken~bff-87dc9/

5. AI enables competition with education institutions on their primary tasks of research and education. How do we as a sector want to respond to developments in tutoring chatbots such as Khan Academy's Khanmigo or academic research increasingly being done using AI by commercial parties such as DeepMind and OpenAI? How is this new competition shaping our own positioning?
6. Where does mandate lie for decisions affecting the entire sector? How do we balance the autonomy of individual institutions with the needs of the sector as a whole?
7. Institutions are increasingly using (AI-based) educational tools provided by edtech or big tech for the organisation, development, and execution of education. Drawn to the extreme, does this mean the future of education is procurement?

4.2 What is needed?

So, considering the broad impact of AI, what actions are needed to respond to these challenges and larger strategic questions? Here, we discuss some signals and suggestions based on insights discussed in this document and provided by various sector stakeholders in a call for input.[20] We identified 4 needs, for: vision, action, collaboration, and literacy.

4.2.1 Need for a broad vision within institutions and on a sectoral level

To respond to developments, institutions and the sector need a broad vision with accompanying action lines/strategic objectives to actualize parts of that vision. Here it is important to:

- Find the sweet spot between acknowledging the disruptive impact of AI and a sober realistic perspective on that disruption. Strategic fore sighting can be of help here.
- Include all relevant stakeholders. AI questions cannot be answered solely at the teacher-, IT-, or policy-level.
- Consider the duty of care that institutions have towards their students. Part of this is also a good technological and philosophical understanding of technologies used in high-stakes applications such as AI-based online proctoring (which can have discriminatory properties) and ChatGPT-detectors (which cannot reasonably work).[21]

[20] See Appendix 4 Stakeholder input

[21] The Netherlands Institute for Human Rights was handling a case in which a student accused her educational institution of discrimination by proctoring software. The board ruled that in this specific case discrimination was not proven but did emphasize the institution has a duty of care to verify that the software it uses is non-discriminatory. mensenrechten.nl/actueel/nieuws/2023/10/17/student-niet-gediscrimineerd-door-ten-tamensoftware-proctorio-maar-vu-had-de-klacht-zorgvuldiger-moeten-behandelen

4.2.2 Need to be proactive and take action

To take control of this development institutions and the sector need to take ownership. This goes beyond creating a vision and means taking pro-active action. Possible directions are:

- Be proactive, not reactive to developments. Stimulate experiments and develop agility.
- Take ownership of the developments. Decide on policy (even if it's changing) instead of vague guidelines. Clarity with policy or frameworks creates room for ownership, creativity, and progress.
- Consider a (re)prioritization of resources, to enable the institution and its stakeholders to respond to these developments.
- Put public values and digital sovereignty central to formulating activities.[22] For example, considering further investment in shared sectoral/public infrastructure.
- Work on clear organisational structure and responsibilities. Institutions should arrange and prepare their staff and students for the uncomfortable aspects of ethical deliberation, which include asking uneasy questions and tolerating tension. A culture of ethical reflection, not moral judgement. A culture that stimulates taking ownership and possibly making mistakes.
- Preparing business operations activities, including the necessary IT infrastructure, to deal with increased use and potential of AI (data flows, storage, security), especially if your ambition is to develop AI applications yourself.

4.2.3 Need for sectoral collaboration, alignment, and commitment

AI developments do not stop at the wall of the educational institution but impact the whole sector and the broader public role of research and education. This requires a collaborative approach, keeping in mind:

- AI has impact across the 'chain'[23] of education (and/or research), meaning we should also collaborate throughout the chain.
- We need to create the right boundary conditions for innovation of education. This means shared visions on what educational science leadership looks like, but also structured support facilities and IT-infrastructure. Make use of sector associations and shared expertise to avoid effort duplication.
- Growing autonomy and sovereignty as a sector might require more collaborative commitment with associated loss of institutional autonomy (think about standards, policy, etc). An urgent question is which parts of these challenges we want to do together and which not.

[22] Also discussed in the draft 'werkagenda digitalisering' and the potential future SURF innovation zone 'Towards digital sovereignty'

[23] Translated 'de onderwijsketen'

4.2.4 Need to invest in developing AI- and data-literacy and build future capabilities

Not all teachers, researchers, and staff-members are well-informed about the chances and risks of AI. Meanwhile students, market parties and the labour market are embedding it in their activities. If we do not educate all the involved stakeholders, the sector will fail to navigate this societal change for the good of students and society.

- Invest in AI- and data-literacy, create time and space to learn and experiment with AI for teachers, researchers, and staff members.
- Invest in in-house knowledge, expertise, and capability to act in the fast-paced world of AI while taking advantage of national resources.
- Take seriously the role towards students, both in demystifying AI as well as to prepare students for future work.

4.3 Final thoughts

If there is one conclusion to take with you from this document, it is about the extent to which this development is systematic and existential of nature. The issues you're facing are faced by most organisations these days. How to take advantage of change while maintaining one's values and role in society. In the public sector, we are in this together and the best way forward is to work together, sharpen our visions and act.

To paraphrase one of our stakeholders: Make use what is already there, collaborate, ask things of SURF and Npuls, get things moving.

5. Literature and recommended reading

Suggested literature:

- Sheikh, H., Prins, C., & Schrijvers, E. (2023). Mission AI - The New System Technology. Springer International Publishing. doi.org/10.1007/978-3-031-21448-6
- European Commission, Directorate-General for Education, Youth, Sport and Culture, (2022). *Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators*. op.europa.eu/s/y44N
- Onderwijsraad (2022), *Inzet van intelligente technologie* onderwijsraad.nl/publicaties/adviezen/2022/09/28/inzet-van-intelligente-technologie
- Holmes, W., Persson, J., Chounta, I. A., Wasson, B., & Dimitrova, V. (2022). *Artificial intelligence and education: A critical view through the lens of human rights, democracy and the rule of law*. coe.int/en/web/education/-/new-isbn-publication-artificial-intelligence-and-education
- UNESCO (2023), Recommendation on the Ethics of Artificial Intelligence unesco.org/en/articles/recommendation-ethics-artificial-intelligence
- SBB (2023), Trendonderzoek KI - trendrapportage.s-bb.nl/trendverkenningen/kunstmatige-intelligentie/ki-algemeen/
- *NOLAI (2022), Referentiekader ru.nl/nolai/kennis-over-ai-in-onderwijs/referentiekader*
- OECD (2021), Artificial Intelligence and the future of science oecd.ai/en/wonk/ai-future-of-science

Npuls, Versnellingsplan and SURF reports:

- Npuls (2023), Smarter Education with AI npuls.nl/en/knowledge-base/smarter-education-with-ai-magazine/
- SURF (2022), Promises of AI in Education surf.nl/en/promises-of-ai-in-education
- SURF (2023), Responsible Tech: On Public Values and Emerging Technologies surf.nl/en/news/responsible-tech-how-we-ensure-new-technologies-meet-public-values
- SURF (2023) Future Campus – Scenario's voor de campus in 2040 (endreport) future-campus.nl/eindrapport-2023/
- SURF (2023), Trend Rapport Future Campus surf.nl/nieuws/trendrapport-future-campus-een-blik-op-de-toekomst-van-de-campus-in-2040
- SURF (2023), Tech Trends report section Artificial Intelligence surf.nl/files/2023-02/sf_trendrapport_h1.pdf
- Versnellingsplan (2022), Dutch Privacy and Ethics Reference Framework for Educational Data surf.nl/en/surf-magazine/using-study-data-responsibly-start-the-conversation

Appendix 1. Notes on AI

Definitions of AI

Historically definitions of AI have changed often. A short description of that history in this passage comes from the SURF report 'Promises of AI in Education':

"Defining 'artificial intelligence' is a complex activity, as its systematic impact results in lots of different people having different perspectives on the technology. When it comes to AI, there is a strong history of speculating about the nature of intelligence and attempting to build parts of it. Often AI is defined as the research that develops technologies that have a capability to do things that would require intelligence if done by humans. As a consequence, our perception on what AI is continuously shifts as we often see AI as the "cool things that computers can't do" and humans can. It is important to realise that AI is more of a discipline than a 'thing', which means it is not 'an AI' but 'an application of AI' or 'an AI method' that we are talking about[24]. Two often used definitions are those by Nilsson and by Russell and Norvig.

> "AI, broadly (and somewhat circularly) defined, is concerned with intelligent behaviour in artifacts. Intelligent behaviour involves perception, reasoning, learning, communication and acting in complex environments."[25]

And

> "In computer science, artificial intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans. Colloquially, the term "artificial intelligence" is often used to describe machines (or computers) that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem solving"."[26]

[24] "A Free Online Introduction to Artificial Intelligence for Non-Experts," Elements of AI, accessed January 19, 2022, course.elementsofai.com

[25] Nilsson, N. J., & Nilsson, N. J. (1998). *Artificial intelligence: a new synthesis*. Morgan Kaufmann. doi.org/10.1016/B978-0-08-049945-1.50005-8

[26] Russell, Stuart, and Peter Norvig. "Artificial intelligence: a modern approach." (2002). aima.cs.berkeley.edu

Both share the placing of intelligent capability within artefacts or systems and an outwards oriented element where the system seems to demonstrate intelligent behaviour. This behaviour might be learning, communicating, or acting; but at least has a proactive element where a system is 'doing' something. A more general definition can be found in the Dutch National AI Course, which defines AI as "*Intelligent systems that can perform tasks independently in complex environments and improve their own performance by learning from experience*"[27].

Another definition of artificial intelligence comes from a recent report by the OECD, which refers to AI as, "*the capacity for computers to perform tasks traditionally thought to involve human intelligence or, more recently, tasks beyond the ability of human intelligence*."[28]

The key word in the OECD definition is 'traditionally', as AI methods and applications have begun to challenge what people should be doing versus what machines should be doing in task-oriented work. As we shall see, the same challenges about what tasks should be done by computer applications and what tasks should be done by people has also begun to ring through the halls of educational institutions.

These definitions might be broad, somewhat circular, and open to interpretation. In legal and policy discussions, AI is often defined more strictly. In the current draft version of the European Union AI Act, the definition specifically refers to an annex list of technologies and approaches that fall under 'AI'.

"Artificial intelligence system' (AI system) means software that is developed with one or more of the techniques and approaches listed in Annex I and can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments it interacts with"[29]

This annex includes technologies based in machine learning, logic- and knowledge based, but also statistical and probabilistic approaches. Policy definitions such as this are oriented on the effect of the technology on people, as can also be seen with the mention of 'content, predictions; where recommendations, or decisions' central to AI have a severe impact on peoples' lives and wellbeing. In the current draft of the AI Act, AI systems used in education are seen as high-risk where AI systems determine access to education or evaluate persons on tests, as they can significantly determine a person's future."

Most recent definitions by important global organisations:
OECD.AI:
"An AI system is a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment."

The European Union AI Act currently has different competing definitions:
European Parliament draft (2023)
'artificial intelligence system' (AI system) means a machine-based system that
- is designed to operate with varying levels of autonomy and that
- can, for explicit or implicit objectives, generate outputs
- such as content (generative AI systems), predictions, recommendations or decisions,
- that influence physical or virtual environments;

European Council draft (2022)
'artificial intelligence system' (AI system) means a system that is designed to operate with a certain level elements of autonomy and that, based on machine and/or human- provided data and inputs, infers how to achieve a given set of human-defined objectives using machine learning and/or logic- and knowledge based approaches, and produces system-generated outputs such as content (generative AI systems), predictions, recommendations or decisions, influencing the environments with which the AI system interacts;

European Commission draft (2021)
'artificial intelligence system' (AI system) means software that is developed with one or more of the techniques and approaches listed in Annex I and can, for a given set of human- defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with;
'artificial intelligence system' (AI system) means a system that
i. receives machine and/or human-based data and inputs,
ii. infers how to achieve a given set of human-defined objectives using learning, reasoning or modelling implemented with the techniques and approaches listed in Annex I, and
iii. generates outputs in the form of content (generative AI systems), predictions, recommendations or decisions, which influence the environments it interacts with;

[27] "Gratis Online Cursus Kunstmatige Intelligentie," accessed April 25, 2022, app.ai-cursus.nl
[28] OECD, *OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots*, OECD Digital Education Outlook (OECD, 2021), doi.org/10.1787/589b283f-en
[29] EC. (2021). Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain union legislative acts (2021/0106 (COD)

WRR report ‘Mission AI’

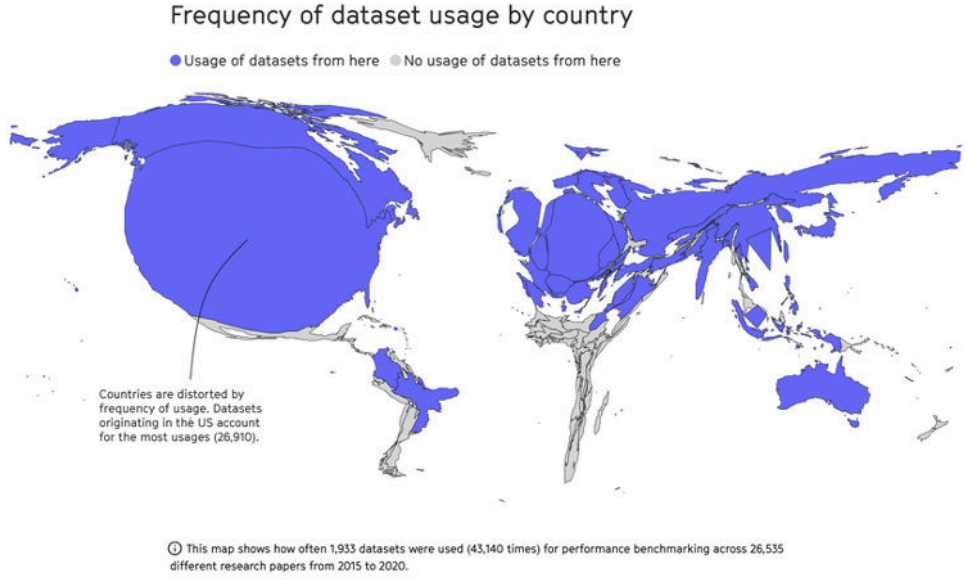
Executive summary copied here for ease of access:

- In recent years, ai has left the confines of the lab and proliferated through- out society. Advances in the fundamental science of ai have led to an increase in the number of patents and, in turn, emergent interest from businesses and governments. The technology has also captured the public’s imagination.
- ai is now being used throughout the economy and society at large, affecting the daily lives of citizens in manifold ways. Therefore, the objective for societal actors, particularly governments, is to develop ways to adequately embed ai in society. To achieve this, we need to understand precisely what type of technology ai is.
- Like what have been called general-purpose technologies, ai is character- ized by pervasiveness, continual improvement and innovational comple- mentarities. However, the wrr has coined the term ‘system technology’for ai in an effort to emphasize the systemic nature of its impact on society. Other examples of system technologies are the steam engine, electricity, the combustion engine and the computer.
- Embedding system technologies within society entails five overarching tasks:
  - **Demystification**: Tackling overly optimistic and pessimistic images and learning to focus on the right questions.
  - **Contextualization**: Making the technology work in practice by creating an enabling socio-technical ecosystem.
  - **Engagement**: Democratizing the technology by involving relevant actors, in particular civil society.
  - **Regulation**: Developing appropriate regulatory frameworks that safeguard fundamental rights and values in the long-term.
  - **Positioning**: Investing in competitiveness and assuring security in an international context.
- For each of the tasks that society faces when embedding ai, we make two recommendations, respectively. Our recommendations for governments are as follows:
  1. *Make learning about ai and its application an explicit goal of governmental policy.*
  2. *Stimulate the development of ‘ai wisdom’ amongst the general public, beginning by setting up algorithm registers to facilitate public scrutiny.*
  3. *Explicitly choose an ‘ai identity’ and investigate in which domains changes in the technical environment are required to realize this.*
  4. *Enhance the skills and critical abilities of individuals working with ai, and establish educational training and forms of certification to qualify people.*
  5. *Strengthen the capacity of organizations in civil society to expand their work to the digital domain, in particular with regard to ai.*
  6. *Ensure strong feedback loops between the developers of ai, its users, and the people that experience its consequences.*
  7. *Connect the regulatory agenda on ai to debates on the principles and organization of the ‘digital environment’ and develop a broad strategic regulatory agenda.*
  8. *Use regulation to actively steer developments of surveillance and data collection, the concentration of power, and the widening gap between the public and private sector in the digital domain.*
  9. *Bolster national competitiveness through a form of ‘ai diplomacy’ that is focused on international cooperation, specifically within the European Union.*
  10. *Know how to defend yourself in the ai era; strengthen national capacities to combat both information warfare and the export of digital authoritarianism.*

Finally, we formulate a recommendation to address the institutional aspects of embedding ai within society:

11. *Establish a policymaking infrastructure for ai, starting with an ai coordination centre that is embedded into the political process.*

Visualising bias in datasets



2022.internethealthreport.org/facts

Appendix 2. Reference Architectures

Lessons from HORA and MORA

The HORA[30] and MORA are reference architecture models for the higher education and mbo institution's digital landscape. To provide an estimate of activities at a modern public educational institution we used the HORA and MORA business function models (bedrijfs-functiemodel). This seems the most accurate representation of institutional activities.

Inspired by the HORA and MORA models we decided to categorise the organisational activities of a modern institution in these activities:

1. Steering of the institution: giving direction to the institution and her societal role
2. The primary processes: the processes through which students are educated or research is being done.
   a. Research
   b. Education
3. Business Operations: the secondary processes to let the primary processes run successfully.

HORA and MORA combination table

	HORA business function model	MORA head process model
Steering	*Steering* - Strategy and governance - Policy and planning - Change management. - Improvements management - Accountability	*Steering* - Strategy and policy and steering - Team organisation and development - ~~Research~~ - Connection to society
	Valorisation - Knowledge dissemination	
Primary processes (research & education) / *Education*	*Education* - Education development - Education execution - Examination - Supervision	*Execution* - Inflow & outflow organisation - Education development - Education execution - Examination - Supervision - Support
	Education support - Student recruitment - Enrolment - Planning - Rostering - Diploma's - Counselling & well-being	
Primary processes (research & education) / *Research*	*Research* - Research development - Research execution - Research dissemination	*Research:* - Research *(research in the MORA is officially placed under 'steering', we moved it here)*
	Research support - Research services	
Business operations	*Information retrieval* - Information transfer/sharing	*Enabling* - Business operations - Information sharing
	Business operations - HR - Finance - Facilities - Procurement - Contact management - Legal - IT (CIO remit) - Communications	

[30] Note: the HORA differs from the HOSA. The HORA is an example of the architecture of a single higher educational institution that other institutions can use as a reference for their own architecture. The HOSA is the agreed upon architecture for shared sectoral services.

Impact of AI in business functions

A possible approach of further investigating the impact of AI on business functions could be to fill in tables like below. Below are speculative examples.

Steering and Governance		
Function	Signal	Impact
Policy and planning	Generative AI use in supporting policy writing	Use of generative AI in the writing of visions and strategies in the sector can start to shape future strategy based on the values in the system.
Accountability	advanced data analytics can help doing structured and efficient reporting. Advanced AI might help with more fuzzy reporting data.	Opportunity: More efficient, comprehensive reporting. Risk: Over-reliance on AI may miss nuanced or non-quantifiable aspects.
Strategy, governance, team-management	Procurement department 'wonders' about the ethics of to be procured systems (outside of compliance)	Nature of questions change, broader than any department. Meaning different internal organisation, capabilities, and mandates.
	Ethical considerations of AI use challenge leadership and require clear responsibilities.	AI, as a disrupting systems technology, impacts the organisation in a way that is crosses departmental boundaries and responsibilities, creating both confusion and urgency. As such leading to unclarity in roles and responsibilities and voids in leadership.

Education		
Function	Signal	Impact
Education execution	Use of generative AI in reviewing and giving feedback on assignments English or Python (signal from stakeholder)	Assessment and feedback are crucial parts of education, but also of sensitive nature. Biases in this phase can have severe consequences for students, so this could be a high-risk applications. If students challenge the teacher's feedback, how will they
Examination	Use of generative AI demands redefining end-terms and curriculum redesign	Study programs need to change in response to new expectations from the relevant work fields.
	Online proctoring applications	The use of online proctoring with a basis in AI has large risks of bias and discrimination.
Participant guidance	AI in career and academic counseling	Stakeholders see both opportunity and risk here. Personalized guidance for students, potentially improving academic performance and career outcomes, and contributing to student well-being.

Research		
Function	Signal	Impact
Research Execution	Automation in experimental setups and data collection	Increased efficiency and accuracy in research activities, leading to higher quality research outcomes and potentially faster breakthroughs. But also questions the integrity of science.
Research Dissemination	AI use to rewrite research output into documents for the general public.	Improved general understanding of scientific output and lower barrier to entry to scientific work by lay-people. However, how do researchers want to take responsibility for rewriten output for lay-people?

Business Operations		
Function	Signal	Impact
Human Resource Management	Getting the right skills into the organisation	Streamlining recruitment processes, predicting staffing needs, and offering personalized training, enhancing employee experience and operational efficiency.
Procurement	Procurement of new AI systems challenges procurement managers, how to deal with systems that have AI embedded.	Requirement for new impact assessments and increased AI literacy in procurement teams.

Another example of this is the document '*4b Ter achtergrondinformatie Quick scan AI impact FORA en HORA*' which describes how AI provides opportunities and value for learners including possible risks.

Appendix 3. Stakeholder input

For the development of this memo, we send out a call for input to select stakeholders in the field, the relevant linking pins of the different csc-bodies, and the SURF special interest group on AI in Education. In the short timeline provided we received input of 10 stakeholders. Additionally, we did a short input gathering workshop with the NLAIC working-group on Education. The input was varied across educational levels. With 5 wo, 2 hbo, 2 mbo, and 1 other amongst the 10 people who provided input. Amongst the NLAIC input there were 7 po/vo, 10 mbo, 3 hbo, 6 wo, and 4 others.

We thank these individuals for their contributions in our call for input:

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- Barend Last, independent educational consultant/SURF
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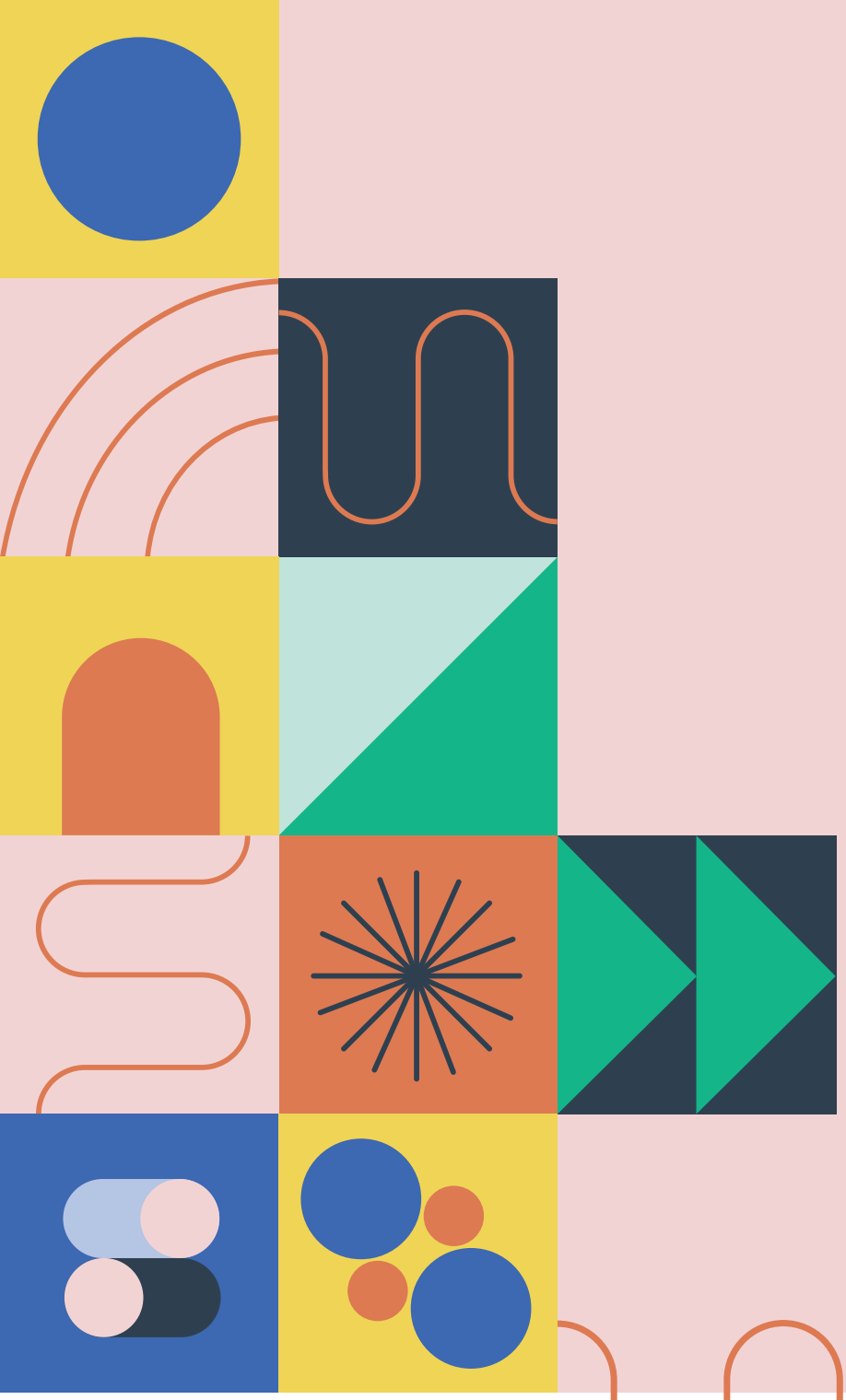
- Heleen van der Laan, ROC van Amsterdam Flevoland
- Frank Benneker, University of Amsterdam
- Corno Vromans, SURF
- Joep van der Graaf, Radboud University]



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education.