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AI and equity.

Vision document

The impact of AI on equity
in tertiary education in the Netherlands

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This vision document was written for Npuls by Theo Bakker (The Hague University of Applied Sciences, project leader and final editing), Irene Eegdeman (ROC Amsterdam and Windesheim University of Applied Sciences), Christian de Kraker (Alfa-college and Hanze University of Applied Sciences), Erdinç Saçan (Fontys University of Applied Sciences) and Anouschka van Leeuwen (Utrecht University). Texts on the AI Act were checked by lawyer Nghitti Saro. Many thanks to all the experts we interviewed. We also thank colleagues at Npuls and SURF who read the vision document for their input. The original vision document was written in Dutch. This English translation was provided by Paula Truyens and Christy de Back.

This publication was presented on 21 November 2024 during Theo Bakker's inaugural speech as Professor in Learning Technology & Analytics at The Hague University of Applied Sciences. Parts of his inaugural speech have been used in this vision document in Chapter 1 and the section 'Highlighted: how to investigate bias in education data'.

November 2024

Introduction

Since the arrival of ChatGPT, systems using artificial intelligence (AI) have quickly become popular in education. Many students and lecturers use AI applications because they help them find information quickly, gain new insights or perform certain tasks more easily. While the use of AI has many benefits, there are also concerns, especially about equal opportunities, or equity. Opinions differ on this, and this vision document is about those different ideas. This vision document focuses on the following question: does the use of AI[a] have a positive or a negative effect on equity in education?

How will AI impact equity?

AI applications are already being used by many students in their studies and by lecturers in their teaching practice. But estimating how AI will impact learning and teaching is proving quite difficult. It is also difficult to estimate what impact AI will have on equity in tertiary education in the Netherlands[b]. That is – vocational education and training schools, universities of applied sciences and research universities. Why is that?

- Not everyone uses the term 'equity' for the same thing. Is it about equal access to education for every student or is it more than that?
- Not everyone knows what is meant by 'AI'. Are we talking about things like ChatGPT (generative AI[c]), about predictive models based on data on students (machine learning[d]) or about something else?
- AI is becoming increasingly popular among education developers. They see opportunities to redesign education using AI so that students can learn better. But there is little or no evidence yet of this. Will AI help deliver on those promises? And will the use of AI have a positive effect on equity or not?

[a] In this vision document we talk about 'AI' instead of 'using AI' for a more readable text.
[b] We use the terms 'tertiary education' and 'educational institutions' to refer to secondary vocational education and training schools (*mbo*), universities of applied sciences (*hbo*) and research universities (*wo*) in the Netherlands. We abbreviate vocational education and training schools as 'VET', universities of applied sciences as 'UAS' and research universities as 'RU'.
[c] A form of AI that allows you to generate content automatically. See also Chapter 2.
[d] A form of AI where computers learn from data. This means that it can make predictions for new situations based on data. See also Chapter 2.

- The impact of AI can differ for each educational institution. How does the type of education or the rules that apply to it affect AI? And what is the impact of differences between educational institutions on equity?
- The way AI is being developed presents a number of challenges. AI systems are far from transparent and the data used to train models often contain prejudices (or 'bias'). What is the impact of these issues on equity?
- Educational institutions depend on Big Tech or startups. Which companies are reliable partners for education, and what influence do educational institutions themselves have on the development of AI?

Suppose you have clarity on these questions. Even then, the possible impact on equity is still uncertain, because – as we will explain later – the ideas that exist on this subject contradict one another. This brings us to the two main questions in this vision document:

1. Will the use of AI have a positive effect on equity in tertiary education in the Netherlands or not?
2. What can educational institutions themselves do, individually or together, to maximise the positive impact of AI on equity and minimise the negative impact?

We aim to answer these questions by means of a literature review, interviews with experts and a questionnaire among colleagues in education.

The main message of this vision is: **if we do nothing, AI is likely to have a negative effect on equity for students rather than a positive effect**. We need to adapt both education and the use of AI applications to ensure that equity is increased and not decreased.

To help you and your educational institution, we have written this vision document on the potential impact of AI on equity in tertiary education. We also provide a practical guide with tools for educational institutions to take advantage of the benefits of AI for equity in education and minimise any negative effects.

Reading guide

First, we clarify the concepts of AI, education data and equity (Chapter 1). Next, we discuss the potential advantages and disadvantages of AI for equity (Chapter 2). In addition, we discuss the new EU law on AI (the 'EU AI Act') but also look at ways to carry out research on equity using education data. Finally, we give advice to colleagues at educational institutions in the Netherlands and Dutch national initiatives, such as Npuls and Kennisnet, in the form of a practical guide (Chapter 3). If you would like to start right away, be sure to read the guide first.

We illustrate the insights based on interviews with experts, questionnaires completed by colleagues in education (the community) and examples collected from practice.

You will find a list of experts we interviewed at the end of this vision document. We also explain how we wrote this vision document and how we used AI in the process.

If you have any suggestions after reading this vision document, please let us know at info@npuls.nl and the community site of the Data and AI pilot hub. We can include them in the next version of the vision document.

1. What are education data, AI and equity?

Before discussing the positive or negative effects that education data and AI can have on equity, it is important to first explain these concepts. The same goes for the concept of ‘analytics’. We do so in this chapter.

What is equity?

Opinions differ on what is meant exactly by equity in education. Some limit themselves to the concept of equal access to good education. Others believe that equity goes further than this. They also think it is important that everyone has an equal chance of getting a degree and finding a job.[1] Others believe that access to art, literature and sport – cultural capital – and contact with others – social capital – are also part of equity. How you look at equity matters for how you think about the role of artificial intelligence (AI) in education.

> “Equity is what we – as educational institutions – can offer to reduce social inequality.”
>
> **Carla Haelermans**, Professor of Human Capital, Education Technology & Inequality, Maastricht University

One thing is certain: equity starts with access to good education. Education helps young people develop personally and become stronger and more confident (or ‘empowered’).[2,3] Unfortunately, the Dutch education system results in unequal opportunities for students, which means that equity in education is a structural problem. Pupils have to choose a level of secondary education after primary school as early as the age of 12. This means that small differences between pupils become bigger early on in their education. Once a pupil is in preparatory secondary vocational education (*vmbo*) or senior general secondary education (*havo*), it is more difficult to move on to another form of secondary education or to higher professional or university education.[1,4]

> “In order to create a level playing field, we need to break the cycles of inequality.”
>
> **Sandjai Bhulai**, Professor of Mathematics, Vrije Universiteit Amsterdam

The lack of equity in education is a problem that runs deep in our society. To address this properly, we will have to make big changes. A student's educational pathway should depend as little as possible on the environment in which they grew up. What is often seen as a student's personal achievement is also the result of that person's environment and the opportunities they have had in the past. If we only look at a student's performance and attribute this to them personally, we ignore these influences.[5]

To create fair opportunities for all, we need to break the vicious cycle of unequal opportunities, which are passed on from parents to children. Sometimes this even means treating students differently, such as giving a student with fewer opportunities more time and attention than another student. This may sound contradictory, but it is an important step to ultimately achieve equal outcomes. Social cohesion and solidarity[e] among students and lecturers are important to solve the issue of unequal opportunities together.

Despite the fact that much is already known about equity in education, this has not always resulted in greater equity. This highlights the need to find new and better ways to deal with inequality and achieve real change. There is the risk of assuming that AI can bring this change, but this is far from certain.

What are education data and AI?

In this vision document, we look at whether equity can be improved through AI. AI makes use of education data, but what are education data and AI?

Education data refers to different types of information used to improve education.[6] This can help to improve the quality of lessons, improve the effectiveness of education, or make learning more efficient, for example. Think of information used to develop new rules or policies in an educational institution, or to carry out research on how to improve education and ensure that students are successful in their studies. Education data is not just about students; it can also be about lecturers or other employees. It is not the case that a certain type of data is always education data, or that it is collected only for that purpose. Basically, almost any information that an educational institution has can be used as education data. This data often comes from an administration, such as enrolments or grades, or from systems designed to support teaching, such as a learning management system.[7]

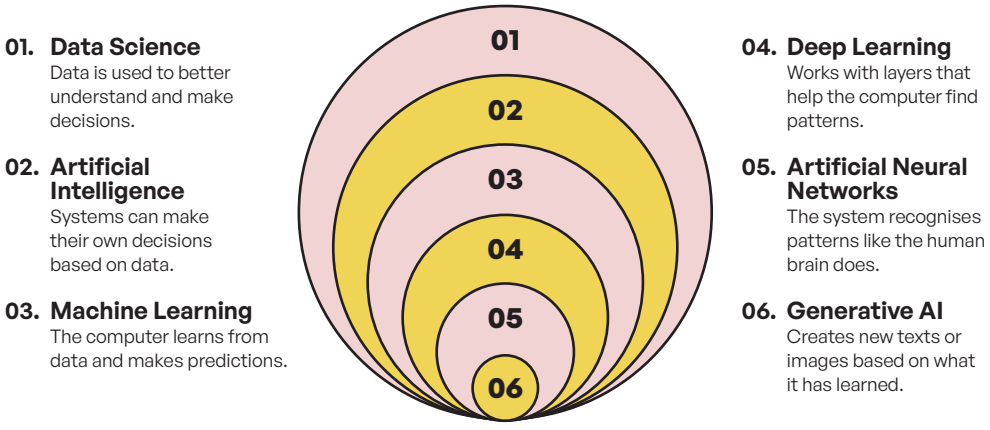
[e] *Social cohesion* means that people feel connected to each other and work together as a group. They trust each other and feel part of the community. Solidarity means that people help each other, especially when someone is struggling. They are willing to work together and support each other to achieve a shared goal.

Artificial Intelligence (AI) refers to systems that can analyse data from their environment – for example, education data.[8] These systems act, or make decisions, based on that data with varying degrees of independence. They make predictions, recommendations or decisions based on their analysis, but they also create content such as texts, images, videos and so on. Intentionally or unintentionally, all these actions have an impact on physical and digital environments. Some of these systems can learn from users and adjust how the system works based on the users' input.

When we think of AI we often think of generative AI, like ChatGPT or Midjourney. These are also called large language models. But AI is a collection of much more than that.[9,10] We explain a few related concepts in a diagram (see Figure 1):

- **Data science** is about collecting, analysing and using data to gain new insights.
- **AI** is – as we have described above – the technology that enables systems to learn and make decisions themselves.
- **Machine learning** is a form of AI where the computer learns from data. This means it can make predictions for new situations based on data, such as education data. An algorithm is a step-by-step process to make a prediction.
- **Deep learning** is a part of machine learning that works with artificial networks that are based on the way the human brain works (neural networks).
- **Artificial Neural Networks** are neural networks that are designed to recognise patterns in data, such as in images, text, or sound.
- **Generative AI** is a form of AI that can create new, unique content, such as writing text or creating images.

You can think of the correlation between the concepts as boxes within boxes. In this vision document, our focus on AI relates to machine learning, which includes prediction models. We also focus on generative AI, which is a few technological levels deeper in machine learning.



Figuur 1 Correlation of concepts in Data Science

What are analytics in education?

A key concept in using data and AI in education is 'analytics'. There are several forms of this (see Figure 2).[11] First we have **learning analytics**. This means that machine learning is used to understand how students study and how lecturers teach based on education data. These insights are then used to improve education. Education data is created during lessons in a classroom or online through the interaction between students, lecturers and the course material.

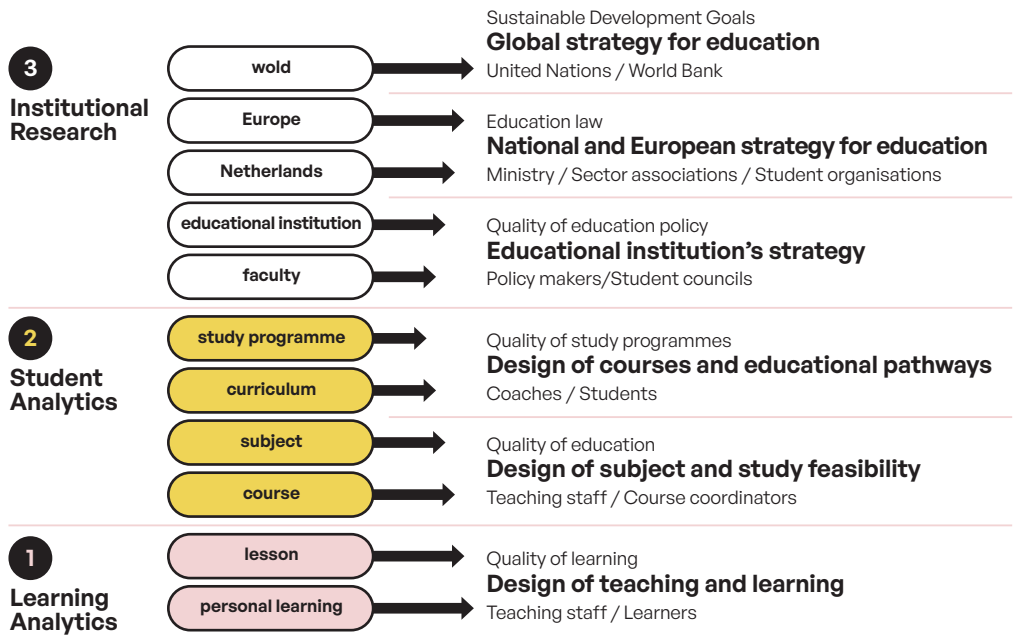
Example
A lecturer looks at which exercises take students more time to complete and compares this with their grades on the final assessment. The lecturer then adapts the lesson and guidance for new students.

We also have **student analytics**. This is about collecting data from multiple subjects or lessons. This includes looking at additional information about students, such as their previous grades or background. This helps us understand how students are doing and what their chances of study success are.

Example
Mentors and career counsellors in VET look at which students are more at risk of dropping out of their programme based on education data. They base this on information from prior education (such as average final exam grades), application date, number of enrolments, attendance, grades achieved in the programme, and absenteeism reports. Using this education data, they can invite these students for mentoring or coaching, help them faster and try to stop them from dropping out – see case A.1.

The final level of analytics is **institutional research**. This looks at how students advance through an educational institution so that educational policy and student teaching and supervision can be improved. Educational institutions look at which study programmes students choose, whether they complete their studies or transfer to a different programme, and what they will do after their studies, such as further education or work. Sometimes student analytics is grouped under institutional research.

Example
A programme manager at a university of applied sciences (UAS) looks at how many students from VET, UAS or RU start the programme each year. The spikes in student numbers in 2020 and 2021 appear to be due to the adjusted final exams in the COVID-19 pandemic period.



Figuur 2 Levels of education data in an educational institution

We now have a better understanding of what equity, education data and AI mean, and know what types of analytics there are in education. The next step is to explore the potential impact of education data and AI on equity.

Sources

In addition to the insights from the interviewees and the community, we used the following sources:

[1] Elffers, L. (2022). *Onderwijs maakt het verschil — Kansengelijkheid in het Nederlandse onderwijs* (Education makes the difference – Equity in Dutch education). Walburg Pers B.V.

[2] Perna, L. W. (2005). The Benefits of Higher Education: Sex, Racial/Ethnic, and Socioeconomic Group Differences. *The Review of Higher Education, 29*(1), 23–52. doi: 10.1353/rhe.2005.0073; Ma, J., Pender, M., & Welch, M. (2016). Education Pays 2016: The Benefits of Higher Education for Individuals and Society. (tech. rep.). CollegeBoard. From files.eric.ed.gov/fulltext/ED572548.pdf; Tinto, V. (2012, March). *Completing College: Rethinking Institutional Action*. University of Chicago Press.

[3] Biesta, G. (2020). *Het prachtige risico van onderwijs* (The wonderful risk of education). Phronese publishers.

[4] Copier, J. (2022). *Tussen idealen en dwalingen. Verhalen over onderwijs* (Between ideals and fallacies. Stories about education). Garant.

[5] Kennisnet (the Dutch public organisation for Education and IT). (2021). *Does adaptive technology lead to more or less equity?* From www.kennisnet.nl/podcasts/leidt-adaptieve-technologie-tot-meer-of-minder-kansengelijkheid/

[6] *What are education data?* (2021). From doe-meer-met-studiedata.nl/article/wat-zijn-studiedata/ (in Dutch). Acceleration Plan Educational Innovation with ICT - Zone Education data. (2021). *Referentiekader privacy en ethiek voor studiedata*, (Privacy and ethics reference framework for education data, version 1.0 (pp. 1–75). From www.versnellingsplan.nl/en/Kennisbank/privacy-and-ethics-reference-framework-for-education-data/. If you have questions about privacy and education data, please read the reference framework.

[7] For a list of different types of education data, see: doe-meer-met-studiedata.nl/article/wat-zijn-studiedata/(in Dutch).

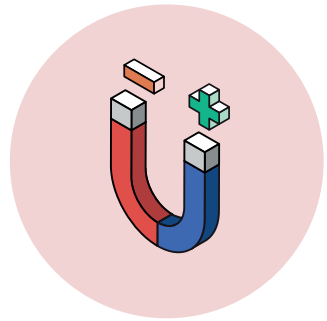
[8,9] Smuha, N. (2018). *A definition of AI: Main capabilities and scientific disciplines* (pp. 1–9). European Commission, Directorate-General for Communication. From ec.europa.eu/futurium/en/system/files/ged/ai_hleg_definition_of_ai_18_december_1.pdf

[10] There are a number of diagrams that show the relationship between concepts such as data science, AI, machine learning and generative AI. This diagram is based on Choi, R. Y., Coyner, A. S., Kalpathy-Cramer, J., Chiang, M. F., & Campbell, J. P. (2020). Introduction to Machine Learning, Neural Networks, and Deep Learning. Translational Vision Science & Technology, 9(2), 14. doi: 10.1167/tvst.9.2.14

[11] Bakker, T. (2023). *Datagedreven transformatie in het hoger onderwijs. Alignment in sense making* (Data-driven transformation in higher education. Alignment in sense making). Presented at *Leiderschapsuitdagingen in data ondersteund werken* (Leadership challenges in data-supported work). Onderwijs editie 4), Erasmus Centre for Data Analytics.

2. The potential impact of AI on equity

When discussing the potential impact of AI on equity, the opinions we gathered were divided. Many negative examples were mentioned where students have been treated unfairly, such as the fraud measures of the Dutch Education Executive Agency (DUO) and issues with online exam supervision – see cases B.1 and B.2. In contrast, others believe that AI is the solution to unequal opportunities. One example is that AI can give a student personalised help and feedback adapted to the right level. The situation is a lot more nuanced. AI can have positive as well as negative impacts on equity. In many cases, these positive and negative impacts are surprisingly interrelated.



In this chapter, we explain exactly how this apparent contradiction arises. Our approach is to look at it from the question of whether AI will have a positive or a negative effect on equity. We deliberately put the positive and negative expectations that may exist next to each other. In doing so, we follow Louise Elffers' classification of equity: opportunities for access to education, opportunities for a diploma and opportunities for access to employment or further education.1 We discuss societal aspects, the impact of AI on education and the interaction between educational institutions, the government, and tech companies.

Impact on society – a new era or more of the same?

"AI acts like a mirror of our society."

Sennay Ghebreab,
Professor of Socially Intelligent AI,
University of Amsterdam

At a higher level – the societal level – we see both positive and negative effects of AI on equity.

Potential positive impact

1. AI is a new era
a) Solves societal problems and inequalities
b) Takes people to a higher level of development

2. AI is objective
a) Compensates for human bias
b) Has a big impact because it can reach many people
c) Enhances our understanding of the world
d) Can be a tool to investigate unequal opportunities in education and processes

3. AI reduces differences
a) Improves individuals' opportunities and increases solidarity
b) Ensures equity for everyone
c) Potentially increases positive impact due to scale

Potential negaitive impact

1. AI is more of the same
a) Reflects and reinforces societal problems and inequalities
b) Limits people's personal development

2. AI is subjective
a) Contains bias due to limited datasets
b) Any mistakes could affect many people
c) It is difficult to understand how AI reaches conclusions
d) Lacks human understanding and correction, which can lead to stigma and exclusion

3. AI widens differences
a) Does not take the social aspect of learning into account
b) Increases differences and reduces the autonomy of students and lecturers
c) Potentially increases negative impact due to scale

1. Does AI mark a new era? Or does it represent more of the same?
Some say that AI marks a fundamentally new era similar to the industrial revolution or the advent of the computer and the internet. AI will lead to an entirely new way of working, including in education; in other words, a paradigm shift. It can take humanity to a higher level of development and be the answer to societal problems and inequalities. Others do not think that AI will change anything. They believe that AI mirrors societal problems and inequalities and may even reinforce them.

2. Is AI objective or subjective?
Those in favour of AI argue that it is objective. AI can help to prevent personal bias and unreasonable decisions – including those of lecturers. If AI has a positive impact on equity, it can help and support many students and lecturers. AI can make new connections, which will give us a better understanding of important issues. This is also true for understanding equity in education, which we can explore more effectively with AI. On the other hand, AI itself can be subjective. This is because AI uses data that has been influenced by differences that already exist in society. Furthermore, these datasets are still limited – data on minorities or non-Western countries are missing, for example.

This means that AI contains the same biases that exist in society – it mirrors them. Bias in data and algorithms can be detrimental to minorities. It can lead to discrimination and less equity – often unintentionally.[2] An example is when some groups of students are not represented in course material created with AI. Another example is when AI misjudges a student's level due to a different background in language. If AI does have these negative effects, it would be a major risk because many students and lecturers could be affected. An additional problem is that it is often difficult to understand how AI reaches its conclusions. And because AI is trained mainly on educational performance, it will not include other important aspects that are not known – such as cultural background or any help from home – in its responses or advice.

3. Does AI reduce or increase differences?
Lecturers play a key role in teaching and learning. AI can help lecturers guide students in different ways so that everyone gets the same opportunities. Given the pressure on the teaching profession and the shortage of teaching staff, this could be useful. But AI can also increase differences without anyone noticing. To stop this from happening, lecturers should be able to correct this.

But lecturers often lack a proper understanding of how data is used, how AI works or the kind of information created by AI. This makes it difficult to correct any mistakes and notice negative effects in time. As a result, stigmatisation and exclusion of students still remain a risk. An additional risk is that educational institutions may want to replace lecturers with AI for all or part of their teaching hours. This could have a negative impact on the balance needed between AI and human contact in education. Another factor is that the scale of AI use could have huge impacts, both positive and negative.

The main question is: does the use of AI have a positive effect on equity and connecting people by creating a level playing field? Or does AI actually have a negative effect on equity because it increases existing differences and leads to loss of autonomy for students as well as lecturers?[3] To better answer these questions, we are looking at the potential impact of AI on equity in education.

Impact on education – more or fewer opportunities?

In this section, we look at the potential impact of AI on access to education and opportunities for good education, but also student guidance during the study programme as well as when applying for an internship or a job.

Potential positive impact

1. AI improves access to education

a) Easy access and 24-hour availability
b) Used by almost all students
c) A vast source of knowledge

2. AI leads to more opportunities for good education and guidance

a) For all students
b) Improves insight into the quality of teaching and assessments
c) Provides personalised, timely guidance and can accommodate different learning paces and needs of students. It can also respond better to the student's situation and learn from it
d) Increases opportunities for minorities, such as students with a migration background, students with fewer financial means, neurodiverse students, students with a visual or hearing impairment, and students with a language delay.
e) Can also provide mental guidance (think of character.ai – a virtual psychologist)

3. AI leads to more job and internship opportunities

a) Increases opportunities for a suitable job by improving general skills
b) Can make application processes fair, such as for an internship or job

Potential negative impact

1. AI worsens access to education

a) Hard to access because of the cost of a laptop/pc or subscription, or due to the policies of educational institutions, or if you are less proficient in languages or your English is not yet good enough
b) Possible advantages are not used much by lecturers yet
c) Not clear what the source of the knowledge is and if it takes sufficient account of diversity

2. AI leads to fewer opportunities for good education and guidance

a) Only accessible by a small group who are literate, have digital skills and are good with AI, or AI is used to replace lecturers for minorities
b) Increased risk of AI fraud due to lack of knowledge on proper use
c) Guidance focuses on the average student, does not properly understand students' situations, and makes incorrect assessments
d) Reduced opportunities for minorities – such as students from migrant backgrounds, students with fewer financial resources, neurodiverse students, students with a visual or hearing impairment, and students with a language delay.
e) Leads to more individualisation and loneliness

3. AI leads to fewer job and internship opportunities

a) Reduces opportunities for suitable jobs due to less personal development and critical thinking
b) Does not solve systemic discrimination in internship or job applications

When we look at the potential impact of AI on education, we see opposing views on the same issues.

> "We can already see the gap widening. Some students use generative AI on a daily basis. Others don't even have access to the internet."
>
> **Heleen van der Laan**, Education Information Manager, Amsterdam and Flevoland ROC, chair of SIG AI in Education and **Parveen Achaibersingh**, Senior BI Advisor, Amsterdam ROC

1. Access to education

AI can improve access to education by giving students access to educational resources and knowledge 24 hours a day – see case A.2. Many students are embracing these new possibilities of AI. On the other hand, getting access to AI-supported education can be challenging for some students, for example due to the cost of a laptop, a pc or a subscription to a version of AI with more features.

AI is also treated differently by different educational institutions. Some educational institutions encourage the use of AI, while others impose restrictions on students and lecturers on the use of AI. This unequal treatment can lead to unequal opportunities between students from different educational institutions. In addition, students may be using AI a lot, but not all lecturers may be taking full advantage of the possibilities yet. This can create big differences in how students use AI in learning and how educational institutions and lecturers respond to it.

2. Opportunities for good education and suitable guidance

AI can improve the quality of education and guidance by giving all students access to personalised support. It can help to gain better insights into the quality of education and assessments. It can offer personalised guidance, adjusted to the pace and needs of students.

AI can even take into account a student's background and learn from it. As long as enough data is available, this increases opportunities for minorities, such as students with a migration background, students with fewer financial means, neurodiverse students, and students with visual or hearing impairments – see Cases A.3 and A.4. AI can also help overcome language barriers – see Cases A.5 and A.6. Additionally, AI can provide psychological support, for example through platforms like character.ai, which can act as a virtual psychologist. Whether these AI applications work, what the consequences are for mental health, and whether they might even lead to avoiding care, is still uncertain.

There are also possible downsides regarding the same topics. AI might work especially well for students who have good digital or AI skills. If this is not taken into account enough, only these students will benefit from AI. There is also a risk of cheating, as students might not know how to use AI responsibly. Sometimes students deliberately cheat with AI. Another concern is that lecturers' biases could be reinforced. Minorities might be more easily accused of misusing AI, even if that is not the case.

AI might also focus too much on the average student and not take into account the special situation of individual students, which can lead to incorrect decisions – see case B.3. AI does not always consider the need for a language level suitable for using the models well for multilingual or non-native students. This can be especially disadvantageous for minorities, especially if the necessary data is not or insufficiently available. As a result, AI could reinforce further individualisation and feelings of loneliness.

3. Job and internship opportunities
AI can help students by increasing opportunities for them to find suitable work. It can support students in developing general skills and ensuring fair job or internship applications, for example. On the other hand, AI can also reduce opportunities to find suitable work if it does not pay enough attention to students' personal development and critical thinking skills. As special as AI technology is, it does not solve the deeper, systemic problems of discrimination in job or internship applications.

> "All tools that are inaccessible to students with different backgrounds increase differences. Not just digital tools."
>
> **Eddie Denessen**,
> Professor of Education and Social Inequality,
> Radboud University

Impact on the context of the educational institution – much or little influence?
Equal opportunities are not only influenced by society or what happens in education, but also by what happens around education. This section is about the possible advantages and disadvantages of the dependency between government, educational institutions, and technology companies. It is a complex interplay of factors.

⊕ Potential positive impact

1. **AI development is progress**
a) Is the most important technological development of our times
b) Makes work easier and more accessible and can speed up tasks

2. **AI strengthens educational institutions**
a) Gives educational institutions the opportunity to innovate
b) Is the next step in the development of education
c) Is efficient and can take over repetitive tasks from lecturers
d) Makes it easier for administrators to carry out their own analyses of education data and make decisions

3. **AI development is fast and the quality is constantly improving**
a) AI is developing at a very fast pace
b) Problems will be quickly solved by rapid innovation, such as solutions for errors and AI with emotions

⊖ Potential negative impact

1. **AI development is a setback**
a) Causes unacceptable pressure on natural and social resources, such as electricity
b) Is mainly made for checks and rules, such as detecting fraud and plagiarism, or to replace jobs for more efficiency

2. **AI weakens educational institutions**
a) Educational institutions depend on large tech companies or small, uncertain startups which the institutions have little influence on and cannot control
b) Development of knowledge about data and AI in educational institutions is lagging behind
c) Makes too many mistakes and requires corrections from lecturers; but lecturers are often not sufficiently trained for this
d) Administrators make less use of critical colleagues, such as policy makers and researchers

3. **AI development is too fast and the quality lags behind**
a) AI development is too fast to organise regulation in time or implement new regulations (EU AI Act)
b) Not certain if problems will truly be solved

1. Technological development and societal effects
The technological development of AI is considered one of the most important developments we have ever made to improve the world. On the other hand, this development also puts unacceptable pressure on natural and social resources, such as electricity, water and financial investments. In addition, AI is often developed for applications that monitor behaviour, such as detecting fraud and plagiarism, or to improve efficiency by replacing tasks or even jobs. When errors occur in the use of AI, correcting these errors becomes difficult and a negative effect can reinforce itself. It becomes more difficult to take responsibility for mistakes and correcting errors often means that people have to redo the work.

> "My concern is that AI is seen as a magical solution where only outcomes are considered, for example results or possible fraud, and action is taken based on those outcomes. The question of 'Why is there fraud?' is not considered."
>
> **Arnoud Engelfriet**,
> Chief Knowledge Officer at ICTRecht

2. Strengthening educational institutions
AI gives educational institutions the opportunity to innovate and is a next step in the development of education. It is efficient because it can take over certain tasks from lecturers. It also allows administrators to carry out analyses and decisions without help because of easily available data.

However, there are also disadvantages. The use of AI shifts the development of education and guidance from educational institutions to tech companies. If educational institutions set up their systems using AI technology developed by large tech companies, they can become too dependent on these companies. Startups sometimes offer creative or unique applications for education, but it is uncertain whether they can keep their promises in the long run. In both cases, educational institutions have little influence and few possibilities to intervene if the systems prove to be detrimental to equity.

In addition, educational institutions still have too little knowledge about data and AI. AI systems also still make too many mistakes and need to be corrected for bias, but lecturers are often not sufficiently trained to notice these mistakes. Administrators can make decisions themselves through data analysis, but this may mean they make insufficient use of advice from experts such as policy makers and researchers. This can lead to confirmation of existing ideas without critically evaluating them.

3. Pace and quality of development
Proponents of AI say that AI is developing at a very fast pace. Because of this rapid innovation, shortcomings like hallucinations[f] or AI without emotions will probably also be quickly resolved. Others wonder whether those deeper shortcomings will truly be solved quickly.

There are also disadvantages to parts that are developed quickly. The rapid development of AI applications sometimes makes this technology itself unpredictable. It is also difficult to make rules in time or to introduce and put into practice new legislation, such as the EU AI Act. There are not enough clear governmental frameworks and educational institutions to regulate this.

[f] A hallucination is a confident answer given by an AI app that does not match the information contained in the app.

Sources

In addition to the insights from the interviewees and the community, we used the following sources:

[1] Elffers, L. (2022). *Onderwijs maakt het verschil — Kansengelijkheid in het Nederlandse onderwijs* (Education makes the difference – Equity in Dutch education). Walburg Pers B.V.

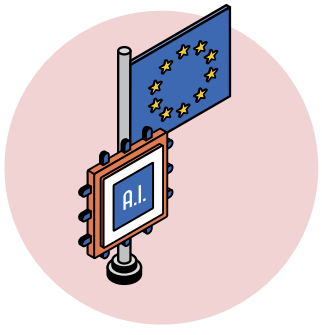
[2] Smeets, E., Geurts, R., & Helvoirt, D. van. (2024). *Algoritmen in het onderwijs. Een onderzoek in opdracht van het College voor de Rechten van de Mens* (A study commissioned by the Human Rights Board), (pp. 1-39). KBA Nijmegen/ResearchNed.

[3] Autoriteit Persoonsgegevens. (2024). *Sectorbeeld Onderwijs 2021-2023* (Education Sector Outlook) (pp. 1–12). From www.autoriteitpersoonsgegevens.nl/documenten/sectorbeeld-onderwijs-2021-2023

[4] Madden, M., Calvin, A., & Hasse, A. (2024). *The Dawn of the AI Era: Teens, Parents, and the Adoption of Generative AI at Home and School* (pp. 1–51). Common Sense Media. From www.commonsensemedia.org/sites/default/files/research/report/2024-the-dawn-of-the-ai-era_final-release-for-web.pdf

Highlighted: the EU AI Act

Before we give practical advice for educational institutions, let us take a look at the European Union's Artificial Intelligence Act.[g] This legislation is important for equity in education. To avoid possible discrimination, certain uses of AI in education are not allowed or are allowed only under certain conditions. On this page, we stick more closely to the formal text of the AI Act on the Digital Government website.[1-4]



The purpose of the EU AI Act is to ensure that citizens, including students, can be confident that AI systems used in education are safe and that their rights are protected. The EU AI Act applies to developers of AI systems and to organisations that use AI, such as businesses and educational institutions. This means that if an educational institution develops or uses an AI system, it is up to the educational institution to check whether this system is prohibited or can be used only under certain conditions.

Risk categories

The EU AI Act divides AI systems into three risk categories. Educational institutions should therefore look into which category the AI system they use falls into so that they know what rules and conditions apply to that system.

1. The first category is *prohibited AI practices*. It is not allowed to use these AI systems. Think of AI systems used for malicious manipulation, unfair social scoring (judging someone unfairly based on social behaviour, which can lead to discriminatory outcomes and exclusion of certain groups) and emotion recognition in education, for example. These AI systems create an unacceptable risk and are therefore banned starting from 25 February 2025.
2. The second category is *high-risk AI systems*. These include systems for biometric identification and categorisation, evaluating job applicants or admitting students into education programmes, for example. These systems are considered a risk for fundamental rights, safety and health. AI systems that determine a person's eligibility for public services or subsidies, such as benefits, also fall into this category. Annex 3 of the AI Act contains a full list of these application areas.5 There are specific requirements for the use of high-risk AI systems. These requirements relate to risk management, data quality, documentation, record-keeping, transparency and human oversight. In addition, a mark of approval is mandatory. It would be wise for educational institutions to check whether their suppliers are preparing for these obligations.
3. The third category is *AI systems with limited or low risk*. These are AI systems that interact with humans or create content that can be misleading, such as deepfakes. Transparency obligations apply to these systems. This means that if an educational institution uses a chatbot, for example, the student should be made aware of this. If the educational institution does not develop but only uses the AI application, it is essential to ask the developer or supplier of the application about this.

Introduction of the AI Act and compliance monitoring

In the Netherlands, there are several regulators that monitor whether organisations comply with the AI Act. For large AI models, compliance will be monitored at EU level by the AI Office.

Under the AI Act, regulators have the right to impose high fines: up to EUR 35 million for each offence, or 7% of the company's global sales figure. For smaller administrative offences, fines can be up to EUR 7.5 million or 1.5% of turnover.

The EU AI Act will enter into force in stages. In the Netherlands, the first rules will come into force on 2 February 2025. This is when they will also start to apply in education. On 2 August 2027, the AI Act will apply in full.

In short, the objective of the AI Act is to make sure that AI systems are fair and do not manipulate or discriminate against people. AI systems should be transparent, have no negative social impact and require consent where necessary. Under the AI Act, applications that do not follow these principles are not allowed in education.

[g] The EU AI Act, the first extensive AI regulation in the world, contains rules on the use of artificial intelligence in the European Union.

Sources

[1] The content of this page has been checked by lawyer Nghitti Saro-Kortmann, LL.M.
[2] See the AI Act of the EU.
[3] For a detailed discussion of the *AI Act, see: Engelfriet, A. (2024). AI and algorithms Mastering legal and ethical compliance*. Amsterdam: Ius Mentis (ICTRecht).
[4] The Npuls project known as 'Privacy and Ethics Reference Framework for Education Data 2.0' explores the consequences of the AI Act for educational institutions in more detail. See npuls.nl/kennisbank/update-referentiekader-privacy-en-studiedata-focus-op-ai-en-mbo.
[5] See ec.europa.eu/commission/presscorner/detail/en/QANDA_21_1683

Highlighted: how to analyse bias in education data?

One topic we discussed is conscious or unconscious bias that can exist in AI and education data. This can lead AI to make incorrect conclusions, which is not good for equity. But AI can also help detect bias in education data. In terms of the AI Act, this is also important for educational institutions that want to use education data in an algorithm. The Hague University of Applied Sciences has used a research method to show how bias can be measured.[1]

Analysis of equity in education data

Research into biases in datasets is called a **fairness-analysis**.[2] A fairness analysis can also be carried out in tertiary education, for example when students enrol for or leave a study programme. The aim is to analyse whether there are forms of bias or not, as these can lead to inequity.

This sample research was carried out at a university of applied sciences. Students starting a study programme at a university of applied sciences often come from very different backgrounds, such as vocational education, secondary school, pre-university education, studies abroad, or other higher education. There are also many different reasons why students stop with their studies. Some students complete their degree, others drop out without a degree, some switch study programmes or go to a research university after their foundation year.

Using **sensitive data** – such as gender, age and social background (parents' education, income and employment) – is important for analysing fairness.[3] Some believe that to avoid bias, these data should not be used. But for this kind of research it is actually necessary to use these data. If you leave out these characteristics, educational institutions will not be sufficiently aware for which students bias does or does not play a role. As a result, outcomes and causes will not be clear.

In fairness analyses, we use AI (machine learning) to build prediction models based on old education data. An important rule for this is the **4/5 criterion**.[4] This means that the differences in equity between different groups in a selection process should not be more than 20%. This criterion is applied to numbers of students entering programmes that include a selection process. It also applies to predicted outcomes, such as whether students are still studying or have dropped out after their first year of study.

Example
A university programme with a selection process has places for 50 students. 100 women and 100 men have enrolled for the programme. The university admits 30 women and 20 men. Does this selection meet the 4/5 criterion? No. If we take the number of women admitted as the base (30) and multiply it by 4/5, we get 24 students (4/5 * 30 = 24). The number of men selected was 20. In this example, men have relatively unequal chances of being selected.

Approach

Analysing fairness consists of three steps:[5]

1. **Making predictive models**: Historical data is used to create models that predict whether a student will still be enrolled after their first year of study. This includes characteristics such as gender, age and prior education.
2. **Determining the importance of characteristics**: After the models have been created, we analyse which features are most important for predictions. This is done for different groups of students, such as men and women or different prior education.
3. **Calculating fairness**: The fairness of the predictions is checked by applying the 4/5 criterion to the outcomes for different groups. If the prediction for certain groups, such as students at vocational education schools, is clearly worse, there is a lack of fairness for that group.

> "By becoming aware of unequal opportunities, we can start to solve the problem."
>
> **Theo Bakker**,
> Professor of Learning Technology & Analytics,
> The Hague University of Applied Sciences

Conclusions

This research provides an AI method that can be used by educational institutions to detect bias in education data.[6] It shows whether different groups of students have unequal opportunities in the current education system that are greater than you might expect. The results of such research provide a basis for further conversations and actions to solve the problem of unequal opportunities in education.

Sources

1 This page is a summary of '*No Fairness without Awareness*', the inaugural speech held by Theo Bakker, Professor of Learning Technology & Analytics at The Hague University of Applied Sciences, on 21 November 2024. See the inaugural speech for a more detailed explanation of this way of researching equity.

2 Barocas, S., Hardt, M., & Narayanan, A. (2023, December). *Fairness and Machine Learning: Limitations and Opportunities*. fairmlbook.org. From www.fairmlbook.org

3 *Handboek over het Europese non-discriminatierecht* (Handbook on European non-discrimination law), 2018 edition. (2018). fra.europa.eu/sites/default/files/fra%5C_uploads/fra-2018-handbook-non-discrimination-law-2018%5C_nl.pdf

4 Code of Federal Regulations. Section 4d, uniform guidelines on employee selection procedures (1978). From www.govinfo.gov/content/pkg/CFR-2011-title29-vol4/xml/CFR-2011-title29-vol4-part1607.xml

5 In the research on variables and fairness, the researchers used the DALEX, DALEXtra and fairmodels packages in R: Biecek, P. (2018). Dalex: Explainers for complex predictive models in r. *Journal of MachineLearning Research*, 19 (84), 1–5. jmlr.org/papers/v19/18-416.html; Maksymiuk, S., Gosiewska, A., & Biecek, P. (2020). Landscape of r packages for explainable artificial intelligence [pages 6, 7, 11, 15]. *arXiv*. arxiv.org/abs/2009.3248; Wisniewski, J., & Biecek, P. (2022). Fairmodels: A flexible tool for bias detection, visualization, and mitigation in binary classification models. *The R Journal, 14,* 227–243. doi: 10.32614/RJ-2022-019.

6 For more information on the potential of AI in research, see Shmueli, G. (2010). To Explain or to Predict? *Statistical Science, 25*(3), 289–310. doi: 10.1214/10-sts330

3. Guide to maximising the positive impact of AI on equity in tertiary education

This chapter gives educational institutions a practical guide on how to use AI in a way that promotes equity and reduces negative effects. This is a big challenge, because equity is a societal problem that is difficult to solve. Our education system also plays a role in this. Is it possible to use AI in a way that it has a positive effect on equity? This vision document assumes that it is in any case necessary to critically consider the role of AI and to provide recommendations.

> "Keep in mind that AI is not a replacement for human contact. It plays a supportive role, and you can also say no to it."
>
> **Monique Leygraaf**,
> Professor of Equity,
> IPABO University of Professional Teacher Education

If we do nothing, AI is likely to have a negative effect on equity for students rather than a positive effect. We need to adapt both education and the use of AI applications to ensure that equity is increased and not decreased.

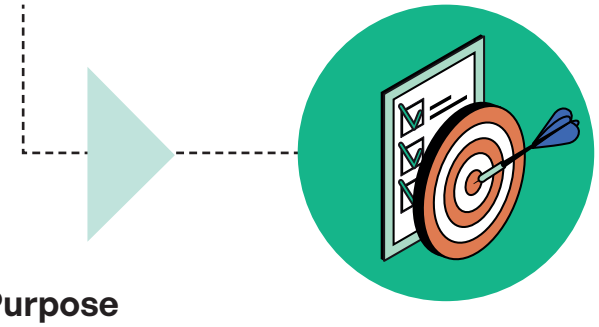
Learning always takes place. But if you organise it, structure it and have someone supervise the learning process, it will be faster and more effective. We call this education. The same applies to AI. In and of itself, AI is not going to solve existing problems. However, it can become a powerful tool in learning.[1]

Educational institutions can do a lot themselves to put AI applications to good use in education. But some things are better dealt with at the Dutch national level. This chapter deals with solutions at institution level and at national level. For an overview of possible solutions, we use the following classification of Sennay Ghebreab, Professor of Socially Intelligent AI at University of Amsterdam. He classifies solutions into five areas: Purpose (why), People

& Perspectives (for whom), Past & Present (what with), Processes & Procedures (how) and Participation & Practice (with whom).[2] The solutions are based on what all interviewees, literature,[3-7] education staff and ongoing Npuls and SURF projects have produced.

What educational institutions can do themselves

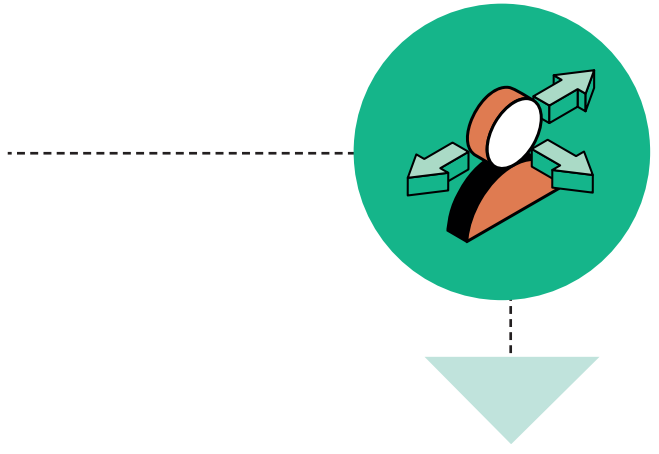
An educational institution can do a lot itself to make equity and AI work well together:



1. Purpose

Choose equity as one of the goals for using AI

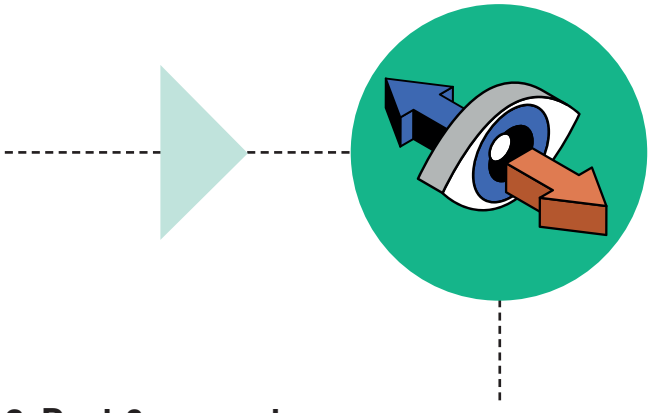
- As a lecturer or an educational institution, think carefully about the purpose of using AI. To do so you can use SURF's Value Compass for Digitalisation in Education, Kennisnet's Ethics Compass or the European Union's ethical guidelines on the use of AI, for example.[8-10]
- The main goals for using AI should be to improve education and for it to have a positive effect on equity. First, clarify and agree with each other exactly what you mean by equity: equal opportunities for access to education, to get a qualification, for work or further study, or also for cultural and social development.[11] Recognise that equity sometimes means that students have to be treated differently to achieve the same results. For example, additional explanation, guidance or time for some students but not for others.
- As a team of lecturers working on the development of education, include the use of AI and its impact on equity in a curriculum at all levels of education. At student level (nano), group level (micro), educational institution or programme level (meso) and the level of national core goals or attainment targets (macro).[12] Spend time on digital skills – including the use of AI – in the curriculum.
- Do not use AI mainly to save time, such as when grading assessments, or to monitor students, such as when detecting fraud. Use AI so that it has a positive effect on equity.
- Be sure to seek a balance between human contact and AI. Don't replace them with each other, but let them complement each other so that they enrich each other.[13] Always ask yourself: is AI really necessary and does it help what you want to achieve with education? Sometimes AI is used because it is a hype and educational institutions are afraid of lagging behind.



2. People & perspectives

Involve a wide target group and diverse viewpoints when creating or using AI

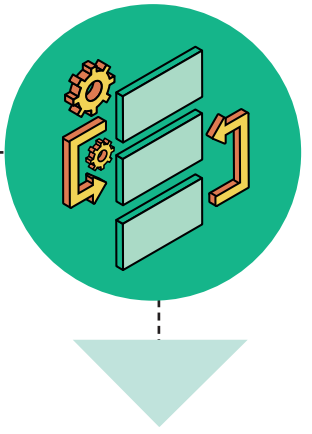
- Involve different groups of people from diverse backgrounds when developing and using AI. This involves both work experiences and personal experiences. Make sure these perspectives find a place in all layers of the organisation: in the executive board, among employees and in participation bodies. Look into systemic inequality in your own institution. Kennisnet's Ethics Compass is also a good tool for this.[9]
- Be aware that general AI solutions are sometimes not a good fit for specific situations in your educational institution or a student's personal situation. For example, adaptive assessment developed in the US may not work well for students with a language delay.
- Think about it in terms of 'difference' rather than 'deficit'. In a fair society, you have to ensure that everyone can participate properly, despite differences. In education, we often look at what students cannot do rather than what they can do. Consider students' personal circumstances. If you use AI, make sure this mindset is included when developing and using it.
- Make sure AI is not only used for individual applications that can widen existing differences. Learning is something we do together. See if AI can also help connect students and strengthen a sense of community.



3. Past & present

Be aware of bias in data and analyse the effects of using AI applications

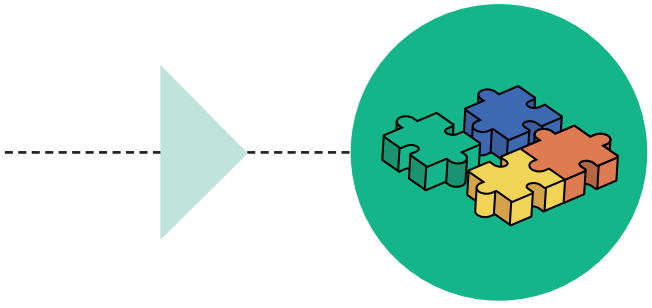
- Be aware that the data used for AI applications may be biased. Using actual cases, investigate what biases these are and take action before using the application. Make sure lecturers are trained to recognise and take into account their own biases as well as those of AI.
- Ask providers what biases are present in their AI applications and how they address these biases so that the application is fair for all students. Explain as best you can to students how the prediction models that are used work, what data were looked at and what role those data play in the model. If an AI application or prediction model is offered, give students the option to choose if they want to use it or not. Inform the students properly about the personal pros and cons of using the AI application or model.
- Develop AI applications specifically for groups of students who are not typical, such as students from migrant backgrounds, neurodiverse students or students with visual or hearing impairments. Assume that students in your educational institution are more diverse than you think.[14]
- Use AI applications that give students personalised feedback and are a good fit with their personal learning pathways but keep the lecturer in charge. Design those AI applications in a way that makes them help students cope with setbacks and become more confident.
- Investigate the effects of an AI application on students and lecturers. For example, does the use of an AI language assistant lead to greater equity among Dutch Caribbean students? (See case B.5). Adapt the application if necessary.



4. Processes & procedures

Be transparent and accountable

- Check which AI applications are being used in your educational institution, who is responsible for them, what exactly these applications do and whether they take equity into account. Make this overview understandable and public. Npuls has created a practical format for this in the national algorithm register for education.
- Investigate whether all students have access to appropriate digital resources, such as a good laptop and software, and whether they know how to use them. Organise this access if it is lacking. Ensure that digital literacy is a regular part of the basic skills that students learn.
- Explain to students and lecturers how AI can and should be used in education. Make it clear who students can contact if they have questions and who is responsible for AI in the educational institution. Ensure that everyone has access to AI through the educational institution. Connect with national initiatives such as the EduGenAI platform by Npuls.
- Check which AI applications are or are not allowed under the AI regulation. Do not do experiments that violate the AI ACT.
- Make sure that the institution's policy on AI is applied consistently across all programmes, subjects and lessons. Also ensure that AI is used carefully and responsibly in education so that it contributes to equity for all students and supports them in their learning process. Evaluate the policy several times a year so that you keep up with new developments.
- Be aware of potential bias in fraud cases handled by examination boards. Consider using AI to generate alternative ideas and viewpoints.
- Combine measures that improve equity in using AI with measures that improve equity in general. For example, extra study guidance to prevent students from dropping out or taking action against internship discrimination.



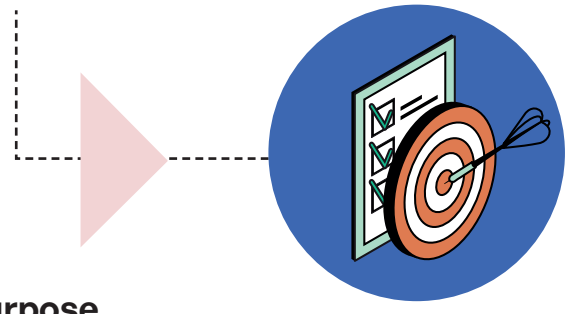
5. Participation & practice

Involve students and lecturers and work together with other educational institutions

- Involve lecturers and students who may be affected by an AI system. Consider testing, monitoring and improving AI, as well as developing course material or rules about AI. Take into account the different ideas lecturers have about how they teach and guide students. Prioritise the values in the Value Compass and involve all users in ethical discussions, for example with the help of the Ethics Compass.
- Work together with other educational institutions and ongoing initiatives in the Netherlands such as Npuls, SURF, Kennisnet and NRO.
- Invest in knowledge and expertise about AI in your educational institution.

What can be done at the national level?

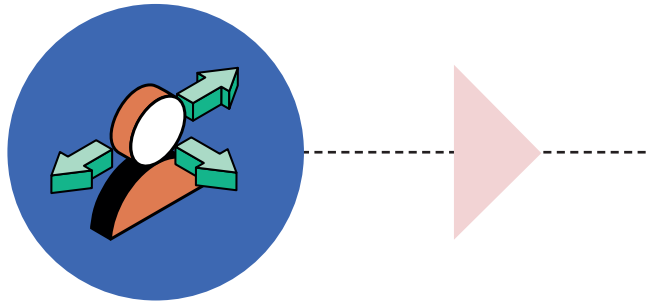
In the solutions we have found for educational institutions, several topics emerge that can be addressed at the Dutch national level by Npuls. Npuls, SURF and Kennisnet already have multiple initiatives that align well with this.



1. Purpose

Choose equity as one of the goals for using AI

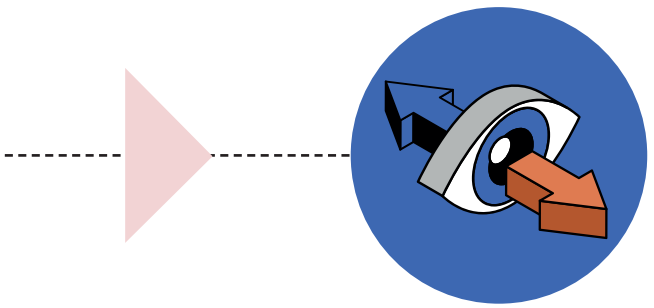
- Make it clear in SURF's Value Compass that equity sometimes means that students have to be treated differently so that the same outcome can be achieved. Broaden the national objectives for the use of AI so that they include the values in the Value Compass, of which equity is one.
- Put AI on the national agenda so that it is included in the development of education at the macro level of curricula (key objectives, final attainment levels, and examination programmes).



2. People & perspectives

Involve a wide target group and diverse viewpoints when creating or using AI

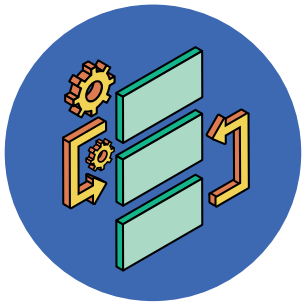
- Encourage the use of AI applications that improve equity for minority groups, such as students with a migration background, neurodiverse students or students with visual or hearing impairments.
- Encourage the use of AI applications that give students personalised feedback and are a good fit with their personal learning pathways. Encourage the use of applications that help students cope with setbacks and become more confident.
- Encourage the use of AI applications that focus on social cohesion and collaborative learning besides individual applications that may increase existing differences.



3. Past & present

Be aware of bias in data and analyse the effects of using AI applications

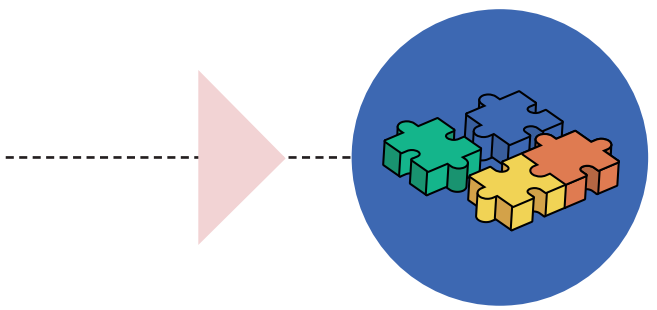
- Encourage the development of methods to investigate bias in data at the national level, for example at the Centre for Educational Data Analytics (CEDA). Support educational institutions in researching the equity aspect of AI applications.
- Make sure that equity is an important part of the acquisition of AI systems and make this a condition.



4. Processes & procedures

Be transparent and accountable

- Add equity to the *Algoritmeregister* (Algorithm Register).
- Develop a clear subsidy scheme for the acquisition of hardware and licences for AI applications for disadvantaged students.
- Include equity in the *AI en Datageletterdheid* (Data Literacy) project by organising a national training course for students and lecturers which educational institutions can use.
- Add equity to the Referentiekader Privacy en Ethiek 2.0 (Reference Framework for Privacy and Ethics) and explain how this can help to improve equal opportunities according to European law. Notify educational institutions as soon as possible about the possible consequences of the AI Act and how they can prepare for it.
- Continue developing the EduGenAI platform and explain how it will improve equity. Be critical of applications that do not comply with the AI Act. Connect this platform to the GPT-NL project of SURF, TNO and NFI for an open Dutch language model.
- Expand the *vraagbaak AI* (Community Data and AI platform – available in Dutch only) with information and advice on AI and equity. Regularly share successful AI applications that have a positive effect on equity so that educational institutions know what works well.



5. Participation & practice

Involve students and lecturers and work together with other educational institutions

- Involve lecturers and students who may be affected by an AI system in taking assessments, monitoring and improving AI, and developing course material. Do this at the national level and prioritise the values in the Value Compass.
- Find out in which areas different educational institutions have the same questions or solutions regarding AI and equity and bring them into contact with each other through the Community Data and AI platform (available in Dutch only).

Sources

In addition to the insights from the interviewees and the community, we used the following sources:

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[7] Wise, A. F., Martinez-Maldonado, R., Hilliger, I., Williamson, K., & Kizilcec, R. (2022). A Review of Learning Analytics Dashboard Research in Higher Education: Implications for Justice, Equity, Diversity, and Inclusion. *LAK22: 12th International Learning Analytics and Knowledge Conference*, 260–270. doi: 10.1145/3506860.3506900

[8] Bok, C., Veld, I. H. in 't, Bomas, E., Dondorp, L., & Pijpers, R. (No date). *Value Compass for Digitalisation in Education* Kennisnet and SURF. From the Kennisnet and SURF website: www.surf.nl/files/2021-09/waardenwijzer_def.pdf.

[9] You can also use Kennisnet's Ethics Compass for further clarification of ethical issues. *Guide to the Ethics Compass - Kennisnet*. (2021). From maken.wikiwijs.nl/156828/

[10] The European Union's ethical guidelines are a good addition to this. (2022). *Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators* (pp. 1–40). From op.europa.eu/nl/publication-detail/-/publication/d81a0d54-5348-11ed-92ed-01aa75ed71a1/language-en. These guidelines focus on four key values. First, **human autonomy and responsibility**. Second, **justice** emphasizes the importance of fairness, inclusion, and equal rights for everyone. Third is focus on **humanity**, with respect for people and their identity. Fourth is **justified choice**, which means that decisions must be based on knowledge and data and be approved by all those involved. All this must be done transparently and in cooperation with others.

[11] A good document for educational institutions to consider when thinking about equity is the *Denkplaat Kansengelijkheid en digitalisering* (Equity and Digitalisation Mindmap – available in Dutch only) by Kennisnet. This mindmap explains how educational institutions can ensure equal opportunities for all students – regardless of their background – with the help of IT. Different themes like school choices, social outcomes and educational results are examined to determine what educational institutions consider fair in education. *Denkplaat Kansengelijkheid en digitalisering - Kennisnet*. (No date). From www.kennisnet.nl/tools/denkplaat-kansengelijkheid-digitalisering/.

[12] See Thijs, A., & van den Akker, J. (2009). *Leerplan in ontwikkeling* (Curriculum in development) Stichting Leerplan Ontwikkeling (SLO), the organisation for further development of curriculum products at each curriculum level.

[13] See the inaugural speech of Inge Molenaar, *Mens-AI samenwerking in onderwijs: De hybride toekomst* (Human-AI cooperation in education: The hybrid future) given on 26 September 2024. www.ru.nl/over-ons/nieuws/terugblik-oratie-inge-molenaar-heel-veel-lijnen-naar-de-toekomst

[14] See Crul, M. R. J., Schneider, J., & Lelie, F. (2013). *Superdiversiteit. Een nieuwe visie op integratie* (Superdiversity. A new vision of integration). VU University Press. www.elitesproject.eu/publications/books.

Cases

In this section, we have collected examples of AI applications that can have a positive or a negative effect on equity.

- Until now, there are not very many cases that increase equity. They are presented in green and with the letter A.
- There are no known cases in tertiary education where AI has decreased equity,[1] although there are some that seemed to do so. In primary education, there is an example of AI applications that were harmful to equity. For a full overview, cases that decrease equity are presented in orange and with the letter B.
- The order of the cases is the order in which they are mentioned in this vision document.

CASE A.1

The invitation rule: faster identification, better guidance

Website	datagedrevenonderzoekmbo.nl/themas/voorspelmodel/praktijkpilot-de-uitnodigingsregel/
Who made it?	VU University Amsterdam and ROC TOP[2]
Where is it used?	• Repeat research: Gilde opleidingen, Onderwijsgroep Tilburg, Albeda, ROC Mondriaan and ROC Amsterdam-Flevoland • Implementation: ROC Amsterdam-Flevoland, ROC Mondriaan, Albeda
Which form of tertiary education?	VET (vocational education and training)

The ‘Invitation rule: faster identification, better guidance’ is an AI application to help students in vocational education who are at a higher risk of dropping out. The system uses education data and AI (machine learning) to determine which students need extra guidance. This information is shared with mentors and career counsellors so they can help these students sooner and stop them from dropping out. This approach allows counsellors to use their time more effectively by focusing on the students who need help the most.

This can improve equity because students who are struggling come into focus sooner and receive the help they need earlier. As a result, they have a better chance of success in their studies. However, there is also a risk with this approach. If the information is not used correctly, some students may be unfairly labelled as being 'at risk', which would in fact reduce their opportunities. It is therefore important that educational institutions use the data properly so that everyone has a fair chance.

CASE A.2

sAxl, AI student coach

Website	www.saxion.nl/nieuws/2024/februari/een-ai-studiecoach-dat-dit-nog-niet-bestaat
Who made it?	Saxion University of Applied Sciences
Which form of tertiary education?	UAS

sAxl is an AI student coach that helps students at Saxion University of Applied Sciences at any time of the day with questions about their studies. These can be questions about exams, facilities, or their well-being. The AI coach provides answers based on information from Saxion University of Applied Sciences. If needed, sAxl refers students to a student coach or other help.

Perhaps unintentionally, the AI coach helps equity because it makes it easier for students to ask for help outside the normal working hours of student coaches. Students who might not have asked for help otherwise can now receive the support they need.

CASE A.3

AI applications for students with disabilities

Website	www.saxion.nl/nieuws/2024/februari/een-ai-studiecoach-dat-dit-nog-niet-bestaat
Who made it?	Bartiméus in collaboration with HAN University of Applied Sciences
Which form of education?	Special education and regular secondary education

AI applications like Be My Eyes help students with visual impairments learn better and be more independent. ChatGPT also helps these students. These AI applications make it possible for students with disabilities to access information, understand graphs, read texts and even learn programming. This is important because it makes course material more accessible for these students.

The applications help students in special and regular education as well as those with multiple disabilities. They ensure that these students can participate in class and increase their chances of success in their studies. In this way, AI increases equity because every student has access to knowledge and tools.

CASE A.4

ModMath

Website	www.modmath.com
Who made it?	It was developed by an independent developer
Which form of education	Primary and secondary education

ModMath is an AI app that helps pupils with language, arithmetic, and writing difficulties (dyslexia, dyscalculia, and dysgraphia). Pupils can use this app to solve mathematical problems digitally without having to write. This is useful for pupils who struggle with methods that require manual writing.

The app is specifically designed for pupils in primary and secondary education. It helps them in a way that is suited to their abilities, which gives them more opportunities to participate in class and improve their arithmetic skills. This promotes equity because pupils with these learning difficulties have the same chances as other pupils.

CASE A.5

AI language assistant

Website	www.inholland.nl/onderzoek/onderzoeksprojecten/conversational-ai/
Who made it?	Inholland University of Applied Sciences
Which form of tertiary education?	UAS

The 'AI Language Assistant' is an AI application for Dutch Caribbean students in higher professional education that helps them improve their Dutch language skills. The system uses AI to identify and solve problems such as word order, articles, and emphasis. Students practice these language components by having conversations with the AI. This application is also used by employees of Corendon travel agency on the Dutch Caribbean islands.

The AI language assistant contributes to equity because it helps students who struggle with the Dutch language. This makes it easier for them to perform well in their studies and careers, which gives them better chances.

CASE A.6

Babel Bear

Website	www.ru.nl/onderzoek/onderzoeksprojecten/babel-beer-voor-jonge-meertalige-kinderen
Who made it?	Stichting Spaarnesant, Universiteit Utrecht and iPABO
Which form of education?	Primary education

Babel Bear is a toy bear that helps children whose native language is not Dutch (NT2 pupils). The bear uses AI to translate the child's native language into Dutch and vice versa. This way, the children can communicate with their classmates and teacher in their own language and be able to follow the class.

This bear is suitable for young NT2 pupils in primary education. Children can join in with classroom activities without language being an obstacle. This increases equity because all children can participate in the same way.

CASE B.1

A fraud algorithm by the Dutch Education Executive Agency

An algorithm of the Dutch Education Executive Agency (Dienst Uitvoering Onderwijs, DUO) identified students with a non-Western migration background who did not live at home as 'high risk' for fraud with a student grant twice as often as other students.[3,4]

DUO, the Dutch organisation that manages student finance, checked students with a migration background more frequently for fraud with the basic grant than other students. DUO used an algorithm to determine which students needed to be checked. It was found that students with a non-Western migration background were more often identified as 'high risk' if they did not live with but nearby their parents. Because of this, inspectors visited these students to check if they were indeed living away from home. Netherlands Statistics (Het Centraal Bureau voor de Statistiek, CBS) has shown that this also happened when the risk of fraud was low.

DUO lost one in four court cases filed by these students, and almost all students who filed a case had a migration background. As a result, the Dutch government apologised and promised to handle checks differently.

This situation shows that using algorithms can lead to discrimination and have a negative on equity for certain groups of students.

CASE B.2

Exam supervision

Challenges of facial recognition software and equal treatment in education (exam supervision).[5,6]

During the COVID-19 pandemic, many students had to take exams at home using software that recognised faces to prevent cheating. A student of colour at VU University Amsterdam had issues with this software and had to direct a bright lamp at her face to be recognised. She filed a complaint because she believed that software discriminated on the basis of skin colour.

The Netherlands Institute for Human Rights ruled that the university did not discriminate by using the software. The problems were due to a poor internet connection or wearing glasses, according to the Institute. However, the Institute did find that the College had discriminated in the way the complaint was dealt with. It was unclear where the student could go with her complaint, and this should have been explained better.

A lawyer explained that it is very difficult to prove legally that an algorithm discriminates, even though there is a lot of scientific evidence that facial recognition software does not work as well for people of colour. The Institute for Human Rights agreed with this. Although there was no evidence of discrimination in this specific case, the Institute did not rule out that AI software like Proctorio could lead to discrimination in other situations.

The student was disappointed but also pleased that her case has led to greater awareness about the use of technology in education.

CASE B.3

Adaptive learning systems

Risks of adaptive learning systems.[7]

The Institute for Human Rights warns educational institutions about the risks of using algorithms in education. Educational institutions use software that automatically helps adjust course material to a student's level (adaptive systems). Although these technologies can be useful, they can also lead to discrimination against students.

Adaptive systems are often used in primary schools. However, these systems can unfairly assign a lower level to students with dyslexia, autism, ADHD and the like because their answers are different from what is expected. Similar issues can arise in universities of applied sciences and research universities, especially for students who do not speak Dutch fluently.

The Institute advises educational institutions to think carefully before using algorithms. They should consider whether the technology truly contributes to better education and does not cause harm. It is often difficult for lecturers to be critical because little to no information available about how the algorithms work exactly. The Institute therefore believes that the Dutch Ministry of Education should help educational institutions with guidelines and research to ensure that everyone has equal opportunities.

Sources

In addition to the insights and cases from the interviewees and the community, we used the following sources:

1 Smeets, E., Geurts, R., & Helvoirt, D. van. (2024). *Algoritmen in het onderwijs. Een onderzoek in opdracht van het College voor de Rechten van de Mens* (Algorithms in education. A study commissioned by the Human Rights Board), (pp. 1-39). KBA Nijmegen / ResearchNed.

2 Eegdeman, I., Cornelisz, I., Meeter, M., & van Klaveren, C. (2022). Identifying false positives when targeting students at risk of dropping out. *Education Economics*, 31(3), 313–325. doi.org/10.1080/09645292.2022.2067131)

3 Source: dub.uu.nl/nl/nieuws/discriminatie-door-duo-erger-dan-gedacht

4 Source: www.rijksoverheid.nl/documenten/kamerstukken/2024/06/11/antwoord-op-schriftelijke-vragen-van-het-lid-soepboer-over-de-discriminerende-vooringenomenheid-door-het-gehele-controleproces-van-fraude-bij-duo

5 Source: eenvandaag.avrotros.nl/item/studente-robin-teleurgesteld-over-uitspraak-dat-ze-niet-gediscrimineerd-is-door-anti-spieksoftware-feiten-blijven-zoals-ze-zijn/

6 Source: www.mensenrechten.nl/actueel/nieuws/2022/12/09/eerste-keer-vermoeden-van-algoritmische-discriminatie-succesvol-onderbouwd

7 Source: www.mensenrechten.nl/actueel/nieuws/2024/05/13/overheid-help-scholen-te-voorkomen-dat-digitale-systemen-hun-leerlingen-ongelijk-behandelen

Annex 1
List of interviewees

We would like to thank the following experts for the insights they provided for this vision document:

- Parveen Achaibersing, Senior BI Advisor (ROC Amsterdam)
- Prof. Sandjai Bhulai, Professor of Mathematics (VU University Amsterdam)
- Giulia Bössenecker MSc., Strategic Adviser for Data & AI (Rijks ICT Gilde)
- Mohamed Bouziane MSc., Equal Opportunities lecturer-researcher (ROC Albeda)
- Prof. Maurice Crul, Professor of Education and Diversity (VU University Amsterdam)
- Prof. Eddie Denessen, Professor of Education and Social Inequality (Radboud University)
- Arnoud Engelfriet, LL.M Chief Knowledge Officer and Programme Director (ICTRecht)
- Ronald Ferket, Lecturer-researcher Data Impact at Kennispact (MBO Brabant) en Data scientist (CINOP)
- Prof. Sennay Ghebreab, Professor of Socially Intelligent AI (University of Amsterdam)
- Prof. Carla Haelermans, Professor of Human Capital, Educational Technology and Inequality (Maastricht University)
- Heleen van der Laan, Information Manager for Education (Amsterdam and Flevoland ROC) and Chair of SIG AI in Education
- Dr. Monique Leygraaf, Professor of Equity (in primary education) (IPABO University of Professional Teacher Education)
- Prof. Marcus Specht, Professor of Digital Education (TU Delft)
- MBA Jim Stolze, writer and entrepreneur
- Dr. Marijke van Vijfeijken, Practor Equitable Education (Koning Willem I College)

Annex 2
Justification of our approach

This vision document was written by a team of colleagues working in secondary vocational education and training schools (mbo), universities of applied sciences (hbo) and research universities (wo). We put this vision document together by using various sources, such as academic articles, websites, a questionnaire for colleagues in education and interviews with experts. We organised, summarised and adapted the information we collected into a clear text ourselves, with the help of AI. In each case, we compared the text with the original material. In this annex, we explain how we did this for each section.

We started collecting **academic articles** and **online examples**. Each team member contributed sources, which we shared through Zotero. We created an overview in Miro with key points for each source, which we then summarised with ChatGPT. We collected several examples and wrote down, for each example, where and when it happened, who was involved and whether the AI helped improve equity. We chose eight of these examples to include in this vision document. We elaborated the example of The Hague University of Applied Sciences, which explores equity in education data, in greater detail.

For the **interviews**, we made a list of about 20 Dutch experts such as researchers, government representatives or interest groups, and entrepreneurs. These experts work in the field of equity, education or technology. We talked to 14 of them online after having sent them the interview questions. We recorded each conversation in Teams, with their permission, and made a report of the conversation. Because the Teams transcripts were not good enough, we made the reports ourselves. We then sent the reports to the interviewees to check if everything was correct. The quotes in this view are from the interviews and have been used with interviewees' permission. We entered the interview reports in Notebook LM as PDF files. Notebook LM allowed us to ask all interviewees focused questions at the same time.

For the **survey among education colleagues**, we published an online questionnaire in Dutch in Microsoft Forms. From May to July 2024, employees at secondary education and training schools (mbo), universities of applied sciences (hbo) and research universities (wo) in the Netherlands were invited to complete an online questionnaire on equity and AI in education. There were 68 responses in total, including 30 from universities of applied sciences, 7 from vocational education and training schools, 2 from research universities and a few from businesses and government. The questions covered equity and AI, relevant resources, examples of AI in education and possible applications.

Two team members went through all the answers. They divided the examples provided into four categories: 1) issues regarding socio-economic background and access to more or fewer resources, 2) bias, selection or discrimination in algorithms, 3) the importance of digital skills, and 4) risks to the quality of education. They categorised the submitted applications into six groups: 1) general comments, 2) AI education and training, 3) lecturers, 4) cognitive skills of students, 5) improving other student skills (such as soft skills), and 6) diversity and neuro-diversity.

In a **workshop** with the writing team, we summarised all the information we had gathered from various sources. We organised this information into a number of topics and made sure opposing ideas were grouped together. We summarised these topics in a PowerPoint presentation, supplemented with background information and examples of AI in relation to equity. We discussed this summary at the **Npuls community day** to see if we had missed any ideas and to discuss what educational institutions can do to increase the benefits of AI and reduce the disadvantages.

We first wrote the **text** of this vision document ourselves (in Dutch) and then had it adapted by ChatGPT to reading level 2F. We checked every ChatGPT proposal and decided for ourselves what we wanted to use or not. After the first draft in Dutch was ready, we went through all the interviews and responses again to make sure the text was complete. We asked a legal expert to review the text on the EU AI Act. We sent the draft version of the vision document to over 40 colleagues and asked them to read it and provide suggestions. We have incorporated their responses into the document. We then showed it to colleagues at Npuls and SURF and student unions ISO and JOBmbo and also incorporated their responses. The vision document was then translated into English by Paula Truyens and Christy de Back. Finally, a designer added images and formatted the text.

Read it online

Moving education.