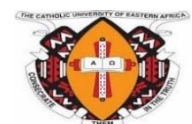


Global synthesis of 1st wave discussions

Global-Education analysis

In 2023, discussions on what it means to be human in the time of neuroscience (NS) and AI have been facilitated by NHNAI partners in 9 different countries. In each country, 3 lines of discussions have been opened to explore this question in the **3 thematic fields of education, health, and democracy**. Each partner then produced 3 **local syntheses** reporting on the content of discussions in these 3 fields in the corresponding countries.¹ On this ground, the coordination team proposed 3 **global thematic syntheses** (one per field explored, education, health and democracy). Finally, ideas of these 3 global thematic syntheses have been grouped to generate one **global-transversal synthesis**, gathering ideas that were more general and have been expressed in different thematic field.

This document presents **ideas of the global-education synthesis**, together with nexuses in which some ideas emerging from discussions enter in conflict and tension, manifesting possible complexities and delicate points of questions related to the topic of education.



¹ For an exact total of 8*3 + 2 local syntheses. In Canada (Québec), Cégep Sainte-Foy organized discussions focused on Democracy and Education, but not on Health.

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Part 1: Global-Education ideas

Being human in the time of NS and AI means ...

Still having relationships and face-to-face interactions with other humans

Face-to-face interaction is a core component of being human, including in the education of human beings. Face-to-face interactions seem to be a fundamental space to learn how to communicate and behave with others, how to live with others in society, and to learn emotions and self-control. That is why school is not just a place to learn facts and theories but remains a fundamental place where social skills are learned and moral values transmitted. These interactions enable discussions and confrontations of different points of views, which open the space of the debate. On top of that, there is an affective dimension within the relation between teacher and learner that could play a major role in the motivation and the attention of the learner, which can be expressed by the teacher's face-to-face presence and passion. Non-verbal communication and body language are important in these face-to-face interactions. School is where humans learn how to make society altogether and how to behave on the basis of an ethical reasoning, which is built through face-to-face and social relations. AI systems and technology may stifle human relations as digital devices and AI tools are used more frequently for pedagogical aims and learners are learning in front of their screens. AI tools cannot replace human presence. As a result, technology may thus foster individualism and people may be less motivated to invest in human relationships.

Involvement in nexuses of complexity (see below [Part 2: Global-Education nexuses of complexities](#)):

- [Making quality education accessible while preserving the human development](#)
 - [I- Making quality education accessible while preserving relationships](#)

Corresponding ideas from local thematic syntheses:

6 countries (BE, CA, FR, TW, PT, USA), 11 claims / ideas

- (Belgium – Education): AI technology as a threat to the students' education
- (Belgium – Education): The psychological risks associated with a highly digitalized education
- (Canada – Education): Preserving the human contact of the teacher-student relationship in education
- (Canada – Education): Online connections between students are no substitute for human interaction
- (France – Education): Maintaining human contacts and preserving the teacher-learner relation
- (Portugal – Education): Human relationships are fundamental to development
- (Portugal – Education): Technology is harmful to social relationships
- (Portugal – Education): Experiencing emotion is exclusive to humans
- (Portugal – Education): Education also occurs outside the classrooms
- (Taiwan – Education): There is something unique about human beings that cannot be algorithmized
- (USA – Education): Competition between human teachers and AI in the field of education

Preserving the fundamental needs required for the human (cognitive) development

AI technologies can harm human development, especially in children and in all his fundamental spheres: physical, psychological, cognitive and social. Notably, by replacing humans in several tasks, one can wonder about the risk of cognitive impoverishment AI can lead to. Moreover, cognitive abilities such as

creativity, problem-solving must be developed through practice. Students' use of AI technologies like ChatGPT can hinder the development of these skills. In addition, an intensive use of technologies can also create addiction, trouble sleeping, cyberbullying and isolation that can be harmful for the human development.

Involvement in nexuses of complexity (see below [Part 2: Global-Education nexuses of complexities](#)):

- [Making quality education accessible while preserving the human development](#)
 - [II- Making quality education accessible while preserving the cognitive development](#)

Corresponding ideas from local thematic syntheses:

7 countries (BE, CA, FR, TW, PT, CH, KE), 10 claims / ideas

- (Belgium – Education): The psychological risks associated with a highly digitalized education
- (Canada – Education): Developing human cognitive skills through practice
- (Chile – Education): Comprehensive training and curricular contents
- (France – Education): Preserving human autonomy
- (France – Education): Fighting against cognitive impoverishment
- (France – Education): Accepting difficulty and fostering self-improvement
- (Kenya – Education): Technology promotes laziness
- (Taiwan – Education): Overdependence on AI will reduce human thinking ability
- (Portugal – Education): Humanity derives from having a mind and a body
- (Portugal – Education): Technology is harmful to development

Using AI and NS to better teach and learn

AI technology can facilitate learning due to a better accessibility of didactic material (online platforms, videos...), by making some tasks easier and faster to complete and by assessing learning outcomes. AI can be used to compensate human limits and could, potentially, lead to develop new kinds of cognitive skills that will be necessary in a future of work and innovation. However, using AI to be more productive requires an understanding of the functioning of AI technology to properly use it, in a way that serves humans.

Involvement in nexuses of complexity (see below [Part 2: Global-Education nexuses of complexities](#)):

- [Making quality education accessible while preserving the human development](#)

Corresponding ideas from local thematic syntheses:

6 countries (BE, CA, PT, TW, FR, KE), 8 claims / ideas

- (Belgium – Education): Pros and cons of employing technology at school
- (Canada – Education): Making humans more efficient
- (France – Education): Undesirable: fighting against informational bubbles
- (France – Education): Compensating human biases
- (Kenya – Education): Monitoring and evaluation
- (Kenya – Education): Opportunity to learn other languages
- (Portugal – Education): Humans have limited cognitive and performance abilities
- (Taiwan – Education): AI can enhance human capacities

Preserving (cultural) diversity and human singularity

Humans are complex, living-beings who cannot be reduced to data or brain. AI and NS may have the tendency to give the impression that human can be understood by creating a complete profile with data and predict his future behaviors or thoughts or by neuroscientific explanations only. But we should rather

prefer a holistic approach that includes biological, psychological and social spheres and aspects of the human life that cannot be reduced to data. Humans are all different, with different spiritualities, and this difference is a richness for humanity that we should preserve from the threat of unification AI and NS can bring.

Corresponding ideas from local thematic syntheses:

4 countries (FR, PT, KE, TW), 7 claims / ideas

- (France – Education): Preserving diversity and accounting for human beings' singularity
- (France – Education): Fostering self and other-understanding thanks to NS and AI
- (France – Education): Taking care of not reducing persons to categories
- (Kenya – Education): AI must be context-driven
- (Kenya – Education): Conflicting spiritualities
- (Portugal – Education): Undesirable: overvaluing children's cognitive abilities may be harmful
- (Taiwan – Education): There is something unique about human that cannot be algorithmized

Preserving human autonomy

Autonomy seems to be a fundamental value to preserve in the time of AI, especially in education. Autonomy allows humans to grow and become capable of thinking by himself and make informed decisions. AI may impact this autonomy by creating dependency, by rendering comprehension less accessible, and by creating a surveilled world. Moreover, humans should remain entirely responsible for AI decisions.

Involvement in nexuses of complexity (see below [Part 2: Global-Education nexuses of complexities](#)):

- [Making quality education accessible while preserving the human development](#)
 - [II- Making quality education accessible while preserving the cognitive development](#)

Corresponding ideas from local thematic syntheses:

7 countries (FR, CA, IT, CH, TW, USA, BE), 8 claims / ideas

- (France – Education): Preserving human autonomy
- (Canada – Education): Preserving autonomy
- (Italy – Education): Protecting learners' privacy and autonomy
- (Chile – Education): Socioemotional skills and development of identity and autonomy
- (Belgium – Education): Undesirable: Uncontrolled use of AI technologies
- (Chile – Education): Education and human development
- (Taiwan – Education): Humans should be ultimately responsible for the decisions made by AI
- (USA – Education): New AI-powered objects and sensors: the internet of things

Developing critical thinking

Critical thinking is a fundamental value and human ability to have in the time of AI and NS. It is crucial to encourage the development of this ability at school. AI might bring more disinformation, compromising the relationship between human and knowledge (or truth), and reduce the potential benefit of education.

Corresponding ideas from local thematic syntheses:

3 countries (FR, PT, IT), 5 claims / ideas

- (France – Education): Developing critical thinking
- (Italy – Education): Fostering critical thinking
- (Portugal – Education): Desirable: as disinformation increases, the promotion of critical thinking in school is key

- (Portugal – Education): Intelligence is exclusive to humans
- (Portugal – Education): Undesirable: knowledge is becoming unimportant

Having time for human flourishing

The time for leisure (or the time that is not work) appears as a precious time to exert humanity and for human flourishing. AI may bring such time as it is more frequently used to replace humans in several tasks. It might help to reach human flourishing by releasing humans from work.

Corresponding ideas from local thematic syntheses:

2 countries (PT, USA), 5 claims / ideas

- (Portugal – Education): Dedicating time to fulfilling activities is essential for individuals to exert their humanity
- (Portugal – Education): Undesirable: the dominance of work in daily life turns humans into robots
- (Portugal – Education): Desirable: education also occurs outside the classrooms
- (USA – Education): Education is instrumentally for work and intrinsically for leisure
- (USA – Education): Religion, human purpose and AI

Seeking the human purpose of education

In the time of AI & NS, it is important to reflect on the purpose of education. For instance, it seems to be easy to cheat with AI and to learn with gamification. This raises questions pertaining to student assessment: What do we want to assess? What is important to evaluate? What do we educate for? And the purpose of learning: why do we learn? Although productivity and performance are economic needs, education should also make the human search for life's meaning a priority. Moreover, overfocusing on success and performance may threaten human development and lead students to consume medication to improve their academic performance, which may be harmful as well as overfocusing on the children's cognitive abilities.

Corresponding ideas from local thematic syntheses:

3 countries (USA, PT, CH), 9 claims / ideas

- (Chile – Education): Education and success-oriented society
- (Portugal – Education): Humans' search for life meaning should be a priority
- (Portugal – Education): The use of medication to improve academic performance among healthy students is harmful
- (Portugal – Education): Overvaluing children's cognitive abilities may be harmful
- (USA – Education): The human purpose of education and how AI aligns
- (USA – Education): Desirable: Education is desirable regardless of economic usefulness
- (USA – Education): Cheating in education by using AI (4 extracts)
- (USA – Education): Undesirable: Using AI to "gamify" education
- (USA – Education): Religion, human purpose, and AI

Preserving creativity

Even if generative AI can be used for creativity, it seems that creativity is something that belongs to humans and sometimes appears through the relation between humans, sometimes through practice. An excessive and exclusive use of AI technologies in education may constrain this ability.

Corresponding ideas from local thematic syntheses:

5 countries (BE, PT, CA, KE, IT), 6 claims / ideas

- (Belgium – Education): AI technology and the job of a teacher

- (Belgium – Education): Integrating AI technologies with traditional pedagogy
- (Canada – Education): Developing human cognitive skills through practice
- (Italy – Education): Fostering critical thinking and creativity
- (Kenya – Education): Technology promotes laziness
- (Portugal – Education): Creativity is exclusive to humans

Things ethically undesirable ...

Replacing human and human's interactions by AI technologies

AI technologies should never replace humans but rather support students and teachers in their job. The teacher-learner relation and face-to-face interactions should be preserved and maintained even in the era of online courses and virtual interactions.

Corresponding ideas from local thematic syntheses:

6 countries (FR, BE, CA, USA, KE, PT), 7 claims / ideas

- (Belgium – Education): Pros and cons of employing technology at school
- (Canada – Education): Face-to-face interaction with teachers and between students must not be substituted by online courses supported by AI technologies
- (France – Education): Human replacement
- (Kenya – Education): Undesirable: Human replacement by machines
- (Kenya – Education): Undesirable: Humans as robots
- (Portugal – Education): Humans should maintain a prominent role in educational contexts
- (USA – Education): Teaching, Learning and Teacher-Learner Relationship

An excessive use of AI that leads to cognitive impoverishment

An excessive use of AI and technologies may seriously impact the cognitive development of youth, notably by catching their attention, developing addictions and creating dependence, rendering them not able to think or doing things by themselves. Moreover, AI can facilitate learning by personalizing it, thus providing diminished opportunity for students to learn skills to adapt to a variety of new experiences.

Involvement in nexuses of complexity (see below [Part 2: Global-Education nexuses of complexities](#)):

- [Making quality education accessible while preserving the human development](#)
 - [II- Making quality education accessible while preserving the cognitive development](#)

Corresponding ideas from local thematic syntheses:

4 countries (FR, CA, BE, TW), 6 claims / ideas

- (Belgium – Education): Uncontrolled use of AI technologies
- (Canada – Education): The use of AI technologies must not hinder the development of cognitive skills considered important for human beings
- (France – Education): automation of uninteresting tasks
- (France – Education): Modifying algorithms to fight against informational bubbles
- (France – Education): making learning easy
- (Taiwan – Education): Overdependence on AI systems

Exacerbating social and economic inequalities with AI

The rapid development of AI is likely to increase the already existing social and economic inequalities, thus rendering this technology accessible to almost exclusively to rich and favored people. This could lead to social control by a few. Moreover, economic conditions are not the only criteria that should be considered when decisions have to be made about AI.

Corresponding ideas from local thematic syntheses:

7 countries (BE, IT, PT, TW, KE, CH, USA), 10 claims / ideas

- (Belgium – Education): The problem of countering economic speculation
- (Chile – Education): Social challenges for educational progress
- (Italy – Education): Equitable access to AI in education
- (Kenya – Education): Desirable: more resources and financial costs for vulnerable people
- (Kenya – Education): Desirable: taking account of AI bias for more inclusivity
- (Kenya – Education): Undesirable: exclusion of African indigenous knowledge
- (Portugal – Education): Undesirable: Technology may increase inequalities
- (Taiwan – Education): AI will deepen the social inequalities
- (Taiwan – Education): Undesirable: Power imbalance leading to social control
- (USA – Education): Concern about harms caused by AI

Things ethically desirable ...

Fostering social inclusion thanks to AI technologies

AI technologies can be used to foster social inclusion through different uses, notably by personalized learning. In fact, personalizing exercises depending on the level and rhythm of the learner may be helpful to prevent dropping out of school or to avoid too large of a gap between students. It is also a manner to consider the diversity and differences between learners. There is the possibility of digital debates that can be an opportunity for shy people to express themselves with others and different translations app to help strangers with language difficulties or vulnerable/disabled people. It enables also to be rapidly informed of what happens in the world. Neurosciences also contribute to this social inclusion by speaking about neurodiversity and communicate a lot about the learner's difficulties (such as dyslexia, ADHD...).

Involvement in nexuses of complexity (see below [Part 2: Global-Education nexuses of complexities](#)):

- [Making quality education accessible while preserving the human development](#)
 - [I- Making quality education accessible while preserving relationships](#)

Corresponding ideas from local thematic syntheses:

6 countries (CH, CA, FR, BE, TW, KE), 10 claims / ideas

- (Belgium – Education): AI technology and social inclusion
- (Canada – Education): The use of AI technologies can complement the teaching provided by a human teacher to enable personalized learning
- (Canada – Education): The use of digital and AI technologies can be an additional way of getting students to debate with each other
- (Chile – Education): AI as an educational tool
- (Chile – Education): Technology as a reflection of society
- (France – Education): Desirable: personalizing learning thanks to AI
- (France – Education): Desirable: Fostering knowledge acquisition and cultural inclusion
- (Kenya – Education): Deaf and Hard of Hearing Supported by AI App
- (Kenya – Education): Opportunity to learn other languages
- (Taiwan – Education): Desirable: Human-AI cooperation in education

Fostering AI & NS literacy

It seems important to foster AI & NS literacy at school for teachers and learners to enable them to be more aware of the ethical and societal issues raised by these technologies, and to be more able to properly reflect on it and on their use.

Corresponding ideas from local thematic syntheses:

2 countries (FR, CH), 4 claims / ideas

- (Chile – Education): Challenges in teacher training
- (Chile – Education): Role of the school in the face of technological changes
- (France – Education): Possessing a minimal level of literacy about science & technology
- (France – Education): Fostering AI & NS literacy

Updating educational approaches (student assessment, teacher training...)

Education should not only consist of memorizing facts but also to support individuals in their search for life's purpose and to encourage them to develop abilities they will need as citizens and autonomous human beings capable of reflecting on the global challenges in the world and preparing to the unknown. Moreover, the integration of AI technologies in education require a review of some educational approaches such as student assessment, teacher and learner training.

Corresponding ideas from local thematic syntheses:

3 countries (PT, CH, USA), 9 claims / ideas

- (Chile – Education): Challenges of the educational system
- (Chile – Education): Challenges in teacher training
- (Chile – Education): Uncertainty and future challenges
- (Chile – Education): Role of the school in the face of technological changes
- (Chile – Education): Spirit of the era and changes in AI
- (Chile – Education): Challenges and optimism facing the future
- (Chile – Education): Continuous adaptation in a post-pandemic education
- (Portugal – Education): Educational priorities should be reviewed
- (USA – Education): Challenge of student assessment due to AI changing education and educational practices

Encouraging ethics in education

Ethics should be an important component of education, including at school and not solely as a reflection that accompanies new technologies. Even if AI technologies should be included with an ethical awareness of the societal issues it raises (notably regarding the ecological crisis but not only), ethics should be a priority in education, notably for learning how to live together and avoid individualism, which may threaten the common good.

Corresponding ideas from local thematic syntheses:

5 countries (PT, CH, FR, IT, BE), 10 claims / ideas

- (Belgium – Education): AI should serve human civilization
- (Belgium – Education): Desirable: an ecological employment of AI technologies
- (Belgium – Education): Desirable: AI technology as an instrument of social sensibilization
- (Chile – Education): Integration of AI in Teaching
- (Chile – Education): Ethical use of AI and technologies in general
- (Chile – Education): Ethics and professionalism in education

- (France – Education): Sharing a common ground
- (Italy – Education): Ethical literacy and mindset
- (Portugal – Education): Desirable: education should be based on values
- (Portugal – Education): Technology is harmful to social relationships

Fairer recognition of all professional jobs

There may exist an inequality of recognition of all types of professional jobs and cursus, and AI may increase this inequality by overvaluing jobs that are related to technological professions whereas the other jobs are key in our society.

Corresponding ideas from local thematic syntheses:

2 countries (FR, PT), 2 claims / ideas

- (France – Education): Desirable: fairer recognition of all types of courses and jobs
- (Portugal – Education): Undesirable: technological professions may become overvalued

Using AI to release humans from work

Since AI can replace humans in several tasks, we should take this opportunity to liberate time for focusing on the essential, such as relationships or anything that fosters human flourishing, and to release humans from repetitive and annoying tasks.

Involvement in nexuses of complexity (see below [Part 2: Global-Education nexuses of complexities](#)):

- [Making quality education accessible while preserving the human development](#)
 - [II- Making quality education accessible while preserving cognitive development](#)

Corresponding ideas from local thematic syntheses:

3 countries (PT, KE, FR), 4 claims / ideas

- (France – Education): Liberating time for focusing on the essential
- (France – Education): Desirable: automation of repetitive or uninteresting tasks
- (Kenya – Education): Technology supplements education
- (Portugal – Education): Desirable: machines replacing humans in certain tasks is efficient and liberating

Need more regulatory measures

The use of AI in education calls for more regulatory measures in order to ensure the protection of humans.

Corresponding ideas from local thematic syntheses:

4 countries (TW, USA, KE, CH), 5 claims / ideas

- (Chile – Education): Ethics and Professionalism in Education
- (Kenya – Education): AI related challenges in education
- (Kenya – Education): Technology risks
- (USA – Education): AI should never harm people
- (Taiwan – Education): Desirable: Need more efficient regulatory measures

Using AI to improve performance and innovation

AI technologies can help us improve our performance by being more efficient. AI can offer new possibilities to increase innovation, particularly in education but also concerning conditions on Earth, such as life expectancy.

Involvement in nexuses of complexity (see below [Part 2: Global-Education nexuses of complexities](#)):

- [Making quality education accessible while preserving the human development](#)
 - [II- Making quality education accessible while preserving cognitive development](#)

Corresponding ideas from local thematic syntheses:

4 countries (CH, PT, TW, BE), 5 claims / ideas

- (Belgium – Education): Desirable: AI technologies as a tool to improve life conditions on earth
- (Belgium – Education): The FLOSS approach as an innovative educational tool
- (Chile – Education): Integration of AI in teaching
- (Portugal – Education): Desirable: scientific and/or technological innovations are beneficial to education
- (Taiwan – Education): Human-AI cooperation in education

Part 2: Global-Education nexuses of complexities

Being human in the time of NS and AI implies carefully exploring nexuses of complexities where valid ideas are nonetheless in tension, manifesting subtleties and challenges one should not overlook. Here are below some examples of **education nexuses of complexities** identified based on **local and global syntheses**.

Making quality education accessible while preserving the human development

I- Making quality education accessible while preserving relationships

The participants highlighted the benefits that AI can bring to education. Starting with digitization, which makes online teaching materials accessible to anyone, facilitating instruction outside class hours, enabling pupils and students to extend the subjects seen in class, and making it easier to catch up on lessons when absent, thanks to online school platforms. Online discussion and debate forums also enable people who are too shy or less comfortable speaking to express themselves. AI presents itself as a virtual assistant that can help with language learning. AI-assisted language learning is becoming more accessible thanks to translation systems, which are now indispensable for people with language difficulties or for the deaf or hard-of-hearing, as mentioned in Kenya and France. And as language learning partly requires oral practice, conversational robots are sometimes more effective than language books. This is exactly what chatbots like ChatGPT can be used for. Used wisely, they can be a formidable pedagogical tool, a necessary aid to learning and complementary to the teacher. In addition, the complementary nature of AI and the teacher was emphasized several times in the discussions, and this is illustrated in particular in the personalization of learning. AI makes it possible to personalize learning paths according to each student's pace, level and ability. As it is physically and cognitively impossible for the teacher to take into account the specificities of each student, AI enables him or her to have an overall view and to identify students in difficulty who are in greater need of support.

But participants also recognize that AI's contribution to education (more inclusion, more access...) very often comes at the expense of face-to-face interaction and human contact, and this concern was almost unanimous in the discussions. The availability of online learning materials can also have the negative effect of encouraging students to invest less time in classroom activities, or even prompting some to drop out and home-school, given that everything is now available online, and within everyone's reach. In Portugal and other countries, there is also a risk evoked that younger people, having become accustomed to this new format of online relationships, will become content with these virtual contacts and underestimate their relational, emotional and physical needs, to the point of becoming distant and cold in contact with others. According to one participant, we can't do without real face-to-face interactions when it comes to learning "how to be, how to know and how to act". But beyond this learning,

it's also in face-to-face interactions that empathy, emotion, mutual and reciprocal understanding - in short, the encounter with the other - come into play. And, as one participant in Canada pointed out, it is sometimes the presence of a teacher and the transmission of his or her passion and emotions that play an important role in the learner's motivation and attention, and therefore in his or her learning. So school is not just a place for learning, but also a place for sharing, meeting new people, and learning to live together, to help society flourish. Through face-to-face interaction, we confront each other, learn social codes and pass on values. Digitalized education, or education that takes place too much behind screens, can ultimately run the risk of reinforcing individualism and egoism, which would be a major brake on living together and a threat to social cohesion.

Ideas from local and global synthesis mobilized in this nexus of complexity:

- [\(Education – Global\) Fostering social inclusion thanks to AI technologies](#)
- [\(Education – Global\) Using AI and NS to better teach and learn](#)
- [\(Education – Global\) Still having relationships and face-to-face interactions with other humans](#)
- [\(Education – Global\) Not replacing human and human's interactions by AI technologies](#)

Expertise input:

- A. Avoiding the disinvestment in human relationships and the commodification of the human being

Based on insights from Brian P. Green,² and Laura Di Rollo³

First, what the participants in the discussions are expressing is a paradox that Sherry Turkle illustrates through the title of her book "Alone together" (2015),⁴ with the concern that young people are no longer investing in human relationships, and that more is expected of technologies than of humans. And yet, education-focused relationships are among the most important relationships we have as humans. Most people, as the participants in the discussions also raise, can remember someone who taught them something, whether it was our parents, a friend, or a teacher in school. These relationships are vital to our humanity and AI puts them at risk, particularly in two ways: 1) as a distraction from learning, and 2) as a replacement for learning. AI which is optimized for grabbing attention distracts students from their work. And AI which generates text and other "education-product-like" objects permit students to replace themselves with AI in the learning process, thus learning significantly less.

Humans need each other, especially for education. Without socialization and education we become feral, like domesticated animals raised in the wild, but in the case of humanity, rude and vice-ridden. In order to become fully human beings, children should not be raised by screens and algorithms, but by other fully human beings.

In addition to the risk of disinvesting in human relationships, digital technologies also present the risk of commodifying the human being, i.e. reducing him or her to an object. Indeed, as Sherry Turkle (2015) points out, the risk is that our "self" is transformed into an online "object-self," where we treat each other more and more like objects and in an expeditious manner. The

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³ Research engineer in cognitive sciences for NHNAI project (UCLy (Lyon Catholic University), UR CONFLUENCE : Sciences et Humanités (EA 1598), Lyon, France)

⁴ Turkle, S. (2015). *Seuls ensemble. De plus en plus de technologies de moins en moins de relations humaines*. Échappée (L').

most telling example is certainly email. Emails are a cognitive load in themselves, but sometimes they're messages from friends or colleagues that we say we need to "deal with" or get rid of so we can cross them off our to-do list, as if we were talking about our dustbins.

Ultimately, the danger is that we lose the feeling of being alive, the way of being-in-the-world that preserves a certain dignity and authenticity, and that only human relationships and face-to-face contact can provide. AI has the potential to be a weapon of mass destruction upon the world's educational system. It needs to be disarmed and instead harnessed as a source of power to assist humans to become better people rather than harm us by enabling the worst parts of our natures. Thus, it seems necessary to strike a balance so as to benefit from what AI can bring us, while preserving those precious human contacts that largely define our humanity, notably through certain attributes. The human voice is to Sherry Turkle what the face is to Levinas.⁵ For Sherry Turkle, it is in the voice that the range of human emotions and the singularity of being are transmitted and heard. For Levinas, it is through the face that the other appears to me in his or her fragility, vulnerability and singularity, which calls for an ethical injunction to protect and not to harm. The face is an interface that enables us to enter into a relationship with others, and through them, with humanity. This raises the question of whether the danger threatening humanity, with relationships mostly at a distance and mostly faceless, is not indifference to the other, and with it, the loss of concern for humanity.

B. Escaping the rise of inequality: Solidarity and Relationships

Brian P. Green

AI as a driver of social and economic inequality is an inescapable question because AI will reduce the value of labor and increase the value of capital, thus driving wealth away from workers and towards owners of AI. How to prepare students today for the strange world of tomorrow, where labor might have no value and only those who already own wealth will retain wealth is an unsolved problem of gargantuan proportion.

Students need to know that a strange future is approaching and to be aware of AI and neuroscience as developing technologies that can affect their futures. Additionally, the uncertainty that will be sparked by these revelations should not be allowed to overpower the growing importance of particularly human pursuits such as seeking ethics, justice, and creating a more caring world. While intellectual labor might be, in some cases, automatable, caring relationships between families and friends can never be automated. Particular human relationships are not fungible and therefore AI can never replace them. The value of family and friends should be re-emphasized and the study of what makes good relationships should be a key part of the revision of education.

You can also find this complexity on the NHNAI website: <https://nhnai.org/focus-on-nexuses-of-complexity-education/>

⁵ Lévinas, E. (1984). *Ethique et infini*. Le livre de poche

II- Make quality education accessible while preserving cognitive development

The participants evoked the advantages of using AI in education. First, AI can help us to be more productive and efficient, because some tasks are easier and faster to complete with AI (such as synthesis production and taking notes process for students, proofreading for teachers...). Moreover, AI and automation allow us to save time that could be used in other activities to exert our humanity, or to focus on other essential things like relationships (evoked in France and Portugal). Another point is that AI can release ourselves from repetitive or uninteresting tasks, which allows us to focus on more profound tasks that need high intellectual activity and might be more interesting/stimulating. Automation can also be a mean to relieve teachers that are exhausted or when they have a health problem (temporarily) – or relieve them from tiring tasks (permanently).

However, participants are also worried about the risk of cognitive impoverishment and loss of autonomy with AI. Automation supposes to delegate/be dispossessed of a certain knowledge (a *know-how*) and to become machine-dependant, thus we are certainly losing autonomy when we are not able to realize a task without a machine or by ourselves. Moreover, by freeing ourselves from a task, we no longer call upon the cognitive capacities that enabled us to carry out this task, we no longer call upon the cerebral areas (like it is the case with the systematic use of GPS that impoverishes activity of cerebral areas associated to space orientation and memory) we need for this action/realization of the task. On top of that, certain cognitive faculties need practice to be developed (such problem-solving, creativity...), notably by trial-error as we are also learning from our mistakes, things that AI doesn't make possible if we are always relying on it for the right answer. And finally, sometimes, even if certain tasks are uninteresting or of "lower level," some of them are associated with and cultivate some values (such as patience, maturity...), or are important for the development of cognitive faculties.

Ideas from local and global synthesis mobilized in this nexus of complexity:

- [\(Education – Global\) Using AI and NS to better teach and learn](#)
- [\(Education – Global\) Using AI to release human from work](#)
- [\(Education – Global\) Using AI to improve performance and innovation](#)
- [\(Education – Global\) Preserving the fundamental needs required for the human \(cognitive\) development](#)
- [\(Education – Global\) Preserving human autonomy](#)

Expertise input:

Based on insights from Juan R. Vidal,⁶ Laura Di Rollo, and Brian P. Green

C. Escaping the law of "the least effort"

Although there could be several beneficial uses of AI in education that can enhance learning (e.g., using ChatGPT before an exam by answering questions about the lesson, providing initial ideas for starting a writing project...), it might be very tempting for students to generalize its use to as many as possible of their academic tasks. Technology such as AI makes some tasks

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easier and appeals to the principle of the “least effort” which, indeed, may be detrimental for cognitive development. This is particularly well illustrated by a study⁷ that suggests that excessive use of generative AIs like chatGPT among students is likely to increase procrastination, memory loss, and impact academic results.⁸

Learning new (intellectual and practical) skills requires practice, and often repetition in order to increase the efficiency and quality of actions regarding their long-term goal. This repetition is not possible without making efforts and often facing frustration when not quite achieving our goal. If the use of technological devices and AI shortcuts these important learning steps, the individual will not acquire the new capacities and knowledge, and will thus be impoverished. It is therefore important to evaluate the use of AI through this “effort-for-learning” lens, that should not be viewed as a waste of time, but rather as the time needed to learn-and-keep the knowledge (be it abstract or concrete know-how). Moreover, making efforts also conveys sense-making in learning, which is important for a person’s identity.

It is thus important to think of the use of technology and AI as a means to potentiate the learning of human capacities as such, and not only to maximize exclusively evaluation scores in the education system. We should use AI as a complementary tool that does not prevent to make cognitive efforts. For instance, AI could be used to help us remind of things we need to do, and not only to do it for us, thereby depriving us of experiences that enable us to grow and flourish. AI could be used as a motivator instead of only/mainly as a facilitator of complex tasks (that are necessary for learning, especially long-term). It is our responsibility to encourage students to strike a balance between technological assistance and personal effort, in order to preserve learning and cognitive development, and to limit as far as possible the sources of distraction that technology can represent.

Indeed, understanding better how we learn and how we are influenced by our environment and our practices, fosters the view of a human being whose freedom to flourish depends on the capacity to control the interactions with all aspects of his environment, especially with technological devices that capture with very high efficiency our attention, depriving us of freely paying attention on what’s happening around us. Neuroscience has given us the means to know why we behave as we do. It gives ground to take action in order to avoid or domesticate interaction with mind-monopolizing artefacts. Neuroscience is also revealing that our brain does not really behave as a computer. The biological nature of the body and its nervous system constrains the type of functionalities it enables for behavior and mind. Neuroscience highlights for instance, in the perspective of sense-making, the crucial proactive engagement of the embodied nervous system in its environment.

D. Preventing the loss of skills: critical thinking and creativity

The use of AI brings along with it the risk of deskilling. There are some sorts of skills that seems to be acceptable to lose, for example skills related to outdated technologies, etc., but there are

⁷ Abbas, M., Jam, F. A., & Khan, T. I. (2024). Is it harmful or helpful? Examining the causes and consequences of generative AI usage among university students. *International Journal of Educational Technology in Higher Education*, 21(1), 10.

⁸ However, this study not only highlights the causal relationship between excessive chatGPT use and cognitive impoverishment. It also shows the causal relationship between excessive use of chatGPT and time pressures and high workload levels. So it's not just AI or technology alone that triggers cognitive impoverishment, but its inclusion in a socio-economic model that overvalues production and consumption, efficiency and speed.

other skills that seem intrinsic to our humanity, skills like those necessary for survival and living in society and understanding the truth. Exactly how we determine what skills to continue teaching and what skills we are all right with losing is a somewhat open question, but there do seem to be skills that we should not lose. For example, critical thinking skills – the skills of philosophy – seem to be particularly important.

With the challenges posed by the integration and overuse of AI in education, we may need to reinvent assignments and activities that cannot be easily solved by AI tools but instead require students to call upon their creativity and critical thinking. Moreover, valuing such activities could motivate students to engage more deeply with the learning process and be more willing to complete tasks on their own.⁹

However, many of the commenters around the world expressed concern that AI might harm our creativity, our critical thinking, our mental development, our social development and so on. These threats should be taken seriously, avoided if possible, and if they start coming true then halted quickly.

Nevertheless, education is also not purely about practical useful skills – it is also about enjoying the more abstract or theoretical aspects of life, pondering the deep mysteries and meanings of the universe. If AI can take away some of the drudgery of life and make us more able to enjoy higher pursuits, as well as other enjoyable human pursuits, then this could be a good outcome.

You can also find this complexity on the NHNAI website: <https://nhnai.org/focus-on-nexus-es-of-complexity-education-2/>

Improving our understanding of the human being while not giving in ontological reductionism¹⁰

In France and in Portugal, participants highlighted that advances in neuroscience and AI are expected to allow identifying students with learning difficulties, notably through neuroimaging and diagnosis. This will allow teachers, parents and counselors to support students and intervene earlier to prevent negative consequences, such as low self-esteem. A better awareness of neurodiversity and identification of a student's learning difficulties and/or mental pathologies can also lead to adapting learning tools and systems for the student, as allows AI algorithms for personalized learning.

However, participants expressed that labeling children with mental pathologies or learning difficulties can also lead to discrimination and stigmatization, and this would be detrimental

⁹ Ibid.

¹⁰ Ontological reduction means that entities at a higher level are considered as nothing more than the sum of their parts (Murphy, Ellis, Connor, 2009, p.4). In this case, it means that a human being is conceived of as nothing more than the information about his/her cognitive functioning we discover/detect in him or her. Jacob, P. (1984). De Vienne à Cambridge. L'héritage du positivisme logique de 1950 à nos jours.

for the person. In Portugal, participants underlined that enhancing our practices for identification of children with low or high cognitive faculties can lead to overfocusing on cognitive performances, thereby to overstimulating or understimulating concerned children with the belief that there is no possibility of improvement and change.

Ideas from local syntheses mobilized in this nexus of complexity:

- (Education – France): Fostering self and other-understanding thanks to NS and AI
- (Education – France): Taking care of not reducing persons to categories
- (Education – Portugal): Scientific and/or technological innovations are beneficial to education
- (Education – Portugal): Overvaluing children’s cognitive abilities may be harmful

Expertise input:

Laura Di Rollo, and Juan R. Vidal

To avoid reducing a person’s identity to just a few characteristics, we should view these learners’ categories as various ways of functioning (rather than as mental disorders), which may lead different persons to express unique abilities in adapting to specific contexts and environments. These abilities can evolve over time and vary depending on situations. Tests and diagnoses, whether provided by a physician or an AI system, offer insights into a person’s cognitive functioning and this information is valuable for understanding her needs. It may enable to offer her appropriate support. However, technic and technology will always extract data and provide parameter values, but it does not fully grasp an individual’s complexity, and this includes his/her inwardness, such as feelings and affect. Global understanding of a person’s uniqueness and depth cannot be grasped if it weren’t through human relationships and interactions. While machines, tests, and evaluation tools can provide useful data, they fall short in capturing the full integrated spectrum of human singularity and its genuine complexity in which the individual recognizes himself. This also includes knowledge from within the inter-subjective space of interaction. The dimension of relationships, therefore, is essential in an embodied approach to understanding people. Still, this information can be helpful for decision-making, as long as it focuses on helping humans to flourish rather than merely being more productive in a reductive framework of evaluation. Logically, categorization, though indicative, should not lead to an automated decision that could bear discrimination and/or exclusion, but should instead support social inclusion.

Although inclusion is promoted in the 21st century, it also brings challenges and dilemmas. One dilemma, as expressed by Ruth Cigman¹¹ involves how we handle differences:

We either treat all children as essentially the same, which means treating them as fairly as possible but with the risk of neglecting individual differences. Or we treat them differently, with the consequences that some are better off than they would otherwise have been, but there is a risk of being unfair by devoting more resources or expertise to some than others.

¹¹ Cigman R. (2007), Included or Excluded? The Challenge of the Mainstream for Some SEN Children (Oxford Routledge). op. cit., p. 137

Cigman, R., & Davis, A. (Eds.). (2009). *New philosophies of learning* (Vol. 2). John Wiley & Sons.

Furthermore, individualization can lead to over-adapting environments to meet the individual needs, as seen with current trends in personalization (like with AI applications). This approach, taken to the extreme, could potentially hinder collective growth and limit people's ability to learn and adapt to various contexts. If the environment is always tailored to fit individual needs, humans may lose the crucial skill of adapting to different situations, and to display the effort to develop the adaptation skill, a vital ability for thriving in the world, for adaptation does not rise passively in living organisms. Even genetically driven adaptations are to be included in modified behavior. Therefore, we need a balanced approach that considers the socio-environmental constraints (achieving performance?) but also biological constraints (learning through self-driven effort), and a balance that maintains a general standard of equality while still allowing room for differences and (neuro)diversity. Achieving this balance is no simple task.

In short, we need a holistic approach to understanding people as complex beings, each with a unique personality, history, with unique beliefs and desires. Such complexity cannot be known through simple categories or labels. While learner categories can offer helpful insights into a person's way of functioning in a specific period, they cannot grasp all the potentialities of individuals. Nothing is set in stone, humans evolve, change and can express new potentialities to learn. Moreover, categories can lead to uniformization, while, for instance, there is no single way for conditions like ADHD or Dyslexia (and others) to manifest in individuals.

In past decades, neuroscience often reduced the brain's functioning to its neurons only, using the computer as a metaphor for brain activity. Through these reduction and metaphors, the brain's functioning tended to be identified with the execution of a program. This approach, largely coming from cognitive sciences, suggested that the brain operates much like a computer. However, this perspective was criticized as "neuro-centrism" for ignoring the roles of the body and emotions. Nowadays, neuroscience has become more inclusive, recognizing that the brain's functioning is closely linked to other organs and the rest of the body. For example, research now highlights the importance of the intestine and microbiome's role in mental health¹² or the influence of breathing and heart rate on brain activity.¹³

You can also find this complexity on the NHNAI website: <https://nhnai.org/focus-on-nexus-of-complexity-education-3/>

¹² Morais, LH., Schreiber, HL, Mazmanian SK (2020). The gut microbiota-brain axis in behavior and brain disorders. *Nat Rev Microbiol.* 2021 Apr;19(4):241-255. doi: 10.1038/s41579-020-00460-0. Epub 2020 Oct 22.

¹³ Engelen, T, Solca M, Tallon-Baudry C (2023) Interoceptive rhythms in the brain. *Nat Neurosci.* 2023 Oct;26(10):1670-1684. doi: 10.1038/s41593-023-01425-1. Epub 2023 Sep 11.