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AI Education!

Six Theses on the Relationship Between Artificial Intelligence, Education, and Society: An Interdisciplinary Perspective

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Abstract
Given the far-reaching social integration of AI systems, education must undergo fundamental change. We summarise these necessary transformations under the term AI Education, outlined below in six theses. We call for a demystification of AI debates in the spirit of digital enlightenment, emphasising a critical, reflective, and multi-perspective approach, while rejecting technology-deterministic and solutionist responses to educational and societal challenges. As a normative framework for shaping AI Education, we propose aligning it with the goals of education for sustainable development. In the context of computer science education, we advocate combining creative-design and analytical-interpretive methods and present architectural and relevance-based perspectives on AI systems. Finally, we underscore the political significance of participation and co-design in AI Education. With these theses, we aim to address the interconnected technological, individual, and societal dimensions, foster interdisciplinary dialogue, and bridge diverse disciplinary perspectives.

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KI-Bildung! Sechs Thesen zum Verhältnis von Künstlicher Intelligenz, Bildung und Gesellschaft aus interdisziplinärer Perspektive

Zusammenfassung
Bildung muss angesichts der tiefgreifenden gesellschaftlichen Einschreibung von KI-Systemen verändert werden. Diese Veränderungen fassen wir unter dem Begriff KI-Bildung und beschreiben sie im Folgenden in sechs Thesen. In ihnen fordern wir eine Entmystifizierung der Debatten im Sinne einer digitalen Aufklärung, betonen die Bedeutung eines kritisch-reflexiven und multiperspektivischen Zugangs und lehnen technik-deterministische und solutionistische Ansätze zur Lösung bildungspolitischer und sozialer Probleme ab. Als normatives Leitbild für die Gestaltung von KI-Bildung schlagen wir eine Orientierung an den Zielen der Bildung für nachhaltige Entwicklung vor. Mit Blick auf die informatische Bildung verbinden wir kreativ-gestaltende mit analytisch-interpretierenden Verfahren und zeigen Architektur- und Relevanzperspektiven von KI-Systemen auf. Abschliessend heben wir die politische Bedeutung der Teilhabe und Mitgestaltung im Rahmen von KI-Bildung hervor. Mit unseren Thesen zu KI-Bildung wollen wir wechselwirkende technologische, individuelle und gesellschaftliche Dimensionen berücksichtigen, die interdisziplinäre Auseinandersetzung befördern und unterschiedliche Fachperspektiven stärker in einen Austausch bringen.

Introduction
The growing use of AI systems across nearly all areas of society—currently exemplified by Large Language Models (LLMs) such as ChatGPT and DeepSeek, and potentially by agentic AI systems in the near future—poses new challenges for education on multiple levels. We refer to the collective responses to these challenges as AI Education, with a strong emphasis on the concept of *Bildung*. This term serves both as a conceptual framework for the following theses and as a reference to Enlightenment and humanist traditions of education, grounded in values such as maturity, emancipation, self-knowledge, world knowledge, and self-determination. At the same time, it deliberately distances itself from purely instrumental or utilitarian understandings of education, aiming to promote a more holistic and empowering vision for the future of learning. AI Education affects all school subjects and the design of teaching and learning processes across the entire educational continuum. Initially, it remains broadly defined. This thesis paper serves as an invitation to articulate AI Education more explicitly and to clarify its relationship to adjacent fields such as media education, computer science education, and personal development. Our aim is to foster interdisciplinary dialogue and to encourage scholars from various disciplines to contribute their perspectives to this evolving discussion.

The aim is to combine a critical-reflective perspective with a design-oriented perspective, whereby design concerns not only the technology, but also individual and socio-cultural dimensions. Beyond the use and education of this technology, it is also about co-design in social responsibility.

This position paper is aimed at all stakeholders who justify and formulate educational goals in formal and non-formal contexts in terms of pedagogy and (subject-specific) didactics. In particular, we are addressing those who design and organise educational processes in schools, universities and vocational training institutions, as well as in extracurricular contexts. We also invite to accompany the observable transformations in an evaluative manner, as the dynamics and consequences of the interacting social and technological developments can hardly be anticipated.

Thesis 1: AI Education should be part of a digital enlightenment that demystifies and objectifies the discussion about AI.

Imagine a world in which only one collective term – 'vehicle' – is used for all means of transport, instead of talking about cars, aeroplanes, trains, ships, bicycles, etc. respectively. How would the public debates on mobility play out in parliaments and talk shows? What would the discourse on CO_2 reduction, traffic calming or transport efficiency look like? According to (Narayanan and Kapoor 2024), who introduce their book "AI Snake Oil" with this comparison, replacing the word 'vehicle' with 'artificial intelligence' results in a fairly plausible description of the conceptual world in which we currently find ourselves. The differentiation and distinction between generative AI and predictive AI, for example, as well as a basic understanding of the respective functionalities from a computer science perspective, are the basis for demystifying and objectifying the discussion. AI Education thus ultimately contributes to the objectification of the discourse by providing a scientific basis for reflection and interdisciplinary background knowledge (Gapski 2021; Schiefner-Rohs et al. 2024).

AI is being discussed in the public eye in countless contexts, from climate change and fake news to intelligent weapons systems. New products and business models are advertised in everyday life, the effects of which on public orders (Verständig 2023), social inequalities and alienation processes can hardly be assessed (Matzner 2024). From a technical perspective, ambiguities, misunderstandings and fictions about AI can be observed (Hicks et al. 2024; Sentance and Waite 2022). The social consequences of the exponential increases in technological development are both underestimated and overestimated. Public discourse often oscillates between dystopian fears of being overwhelmed and utopian wishful thinking about a future with AI.

In order to objectify the discussion about AI systems, a differentiated view of the technologies themselves is required, as well as of the opportunities and risks in the context of the interactions between individual, technological and social dimensions (Heinlein and Huchler 2024). In principle, interaction processes between the media-technological, individual and social levels can also be assumed with regard to AI (Mühlhoff 2023). Recognising these interactions also means turning away from technological centring and shortcuts: The introduction of AI in society alone does not lead to better social systems or better education, but only its social, normative and cultural embedding can achieve this (cf. Rizvi et al. 2023). AI systems alone never represent the solution to social problems in the sense of so-called solutionism (cf. Bartl 2023; Morozov 2014), but rather these are integrated into political, economic, legal and other contexts, and AI systems can potentially make a helpful contribution to their processing. The recent developments surrounding AI are the perceptible result of technological developments and economic, cultural and political advances.

In this complexity, AI poses far-reaching challenges for education and participation (Macgilchrist et al. 2024; Selwyn 2022). These challenges relate to learning *with* AI as a didactic tool, to learning *through* AI in the sense of analysing and better designing learning processes, as well as to learning *about* AI in terms of design and the effects on individuals and society. Learning with AI should be accompanied by a critical-reflective dimension of learning about AI.

Thesis 2: AI Education is a multi-perspective and interdisciplinary challenge. It requires critical reflection and judgement in the context of individual and social behaviour

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Today, AI systems have become part of many people's everyday lives without always being recognised as such. To outline one example: Links to AI can already be found in communication with social media: the technology companies are not just infrastructure providers, but collect the data generated by all interactions and intervene in the generation and curation of content with commercial interests. They use the data – content and communication metadata – for training purposes for AI and for their value chains, thereby helping to defi ne the rules of the game for both society and individuals. The psychographic targeting of marketing-relevant target groups or the automation of communication services with the help of large language models (LLM) is in the commercial interest of digital economic players. Due to the consolidation of power among a few global players (Dolata 2018), there is a need for

political regulation, which is difficult to implement. At the same time, individuals experience a lack of alternatives and a loss of control over their own data, despite the right to informational self-determination (Hagendorff 2017).

While a differentiated understanding of data, algorithms, and the functioning of AI forms the essential basis for an informatics-oriented understanding of AI, AI Education also encompasses broad interdisciplinary background knowledge. This can be summarised with relevant questions:

- What does correlation mean in contrast to causality? How should probability statements be interpreted as the result of predictive AI systems? (mathematics) (Mainzer 2018)
- How should the quality of data be assessed? What bias is there in the (training) data? (communication science, critical data studies)? (Hepp et al. 2022; Sander 2024)
- What business models do AI system providers have? What new data-driven marketing opportunities are there? (economics, marketing) (Boßow-Thies et al. 2020)
- What psychological mechanisms are at work when dealing with data (cognitive bias) and how are they used by platform providers (nudging, attention engineering)? (psychology) (Campbell 2022)
- What does informational self-determination mean? Which legal bases are relevant for consumers or authors? (legal science) (Roßnagel and Friedewald 2022)
- Where does the data from educational contexts flow to and which private-sector data monopolies are establishing themselves in the education system (educational science, economics)? (Hartong and Renz 2024)
- What discrimination and power asymmetries could arise through the use of AI systems? Which groups are vulnerable? (sociology) (Eubanks 2018; Kolleck and Orwat 2020; Wachter et al. 2021)
- How do we talk about AI? Which anthropomorphisations and metaphors influence the discourse on AI? (linguistics, philosophy of language) (HIIG 2025; Wyatt 2021)
- How is our image of AI shaped by media and Sci-Fi? What cultural power, what potential for manipulation and creativity does generative AI possess? (media education, media studies) (Ernst et al. 2019)
- What are the resource requirements? What sustainability issues (energy requirements, raw materials, social issues, such as clickwork) does AI raise? (ecology) (Crawford 2024)

- What impact does AI have on democracy? (from deepfakes to new opportunities for participation)? What are the political implications of algorithmic regulation? (politics, political (media) education) (Besand and Rentsch 2024; Gapski et al. 2017)
- What does creativity mean? What does machine ethics mean? What post- and transhumanist positions are there? (philosophy, ethics) (Funk 2024; Misselhorn 2022; Schönmann and Uhl 2023)

These and other questions with their disciplinary perspectives point to the need for an interdisciplinary approach in the context of AI education. Thesis, discussion or position papers as well as recommendations for action are already available on the topics and perspectives (in particular on AI and LLM (cf. European Education and Culture Executive Agency 2023; CAIS 2024; Kasneci et al 2023) as well as on more general positioning (cf. the Dagstuhl and Frankfurt Triangle (Brinda et al. 2016; 2021), European competence frameworks such as DigComp (Vuorikari et al. 2022), the further development of the German KMK strategy (Braun et al. 2021; SWK 2024). These provide initial answers and have initiated discussions. This paper is intended as a further contribution to these discussions and thus aims to emphasise critical and interdisciplinary perspectives more strongly and to bring them into an exchange.

The diverse interdependencies between AI and education (and Bildung) can also represent an opportunity to pursue an integrative approach across disciplines. AI systems cannot be used in an informed way by just practising clever ‘prompting’.

AI creates new spaces – both physical and virtual – and influences the way we move in the world, how we perceive and how we act. Therefore, AI education is more than just understanding technical processes; it is embedded in a critical-reflexive relationship about the social, cultural and physical effects of AI on people’s living environments.

Thesis 3: AI Education falls short when AI systems are presented as a solution to problems in the education system, such as the shortage of teachers and the increasing diversification of learning achievements

Many proposals for the use of AI systems in schools follow the traditional argumentation patterns of solutionism (Morozov 2014). For example, it is suggested that with their help, pupils could be better supported individually and their learning defi cits could be remedied without having to employ more staff. Other advantages of using large language models, for example, are that they can be used to better meet specific needs, interests and motivations.

However, the hopes and wishes previously associated with the use of computer-based, interactive, multimedia, networked and digital systems have not been fulfilled. This may be due to the fact that the technologies have only now matured to such an extent that the old promises of programmed instruction (as well as cybernetic or information-theoretical control of teaching and learning) appear to be realisable (Fickermann et al. 2020). However, it is more likely that there are fundamental challenges that relate in particular to the need to socially integrate learning processes. The use of AI systems aimed exclusively at individualisation harbours the risk of narrowing learning processes to (pre-)defined, standardised and controlled learning paths (Hartong 2019; Hartong and Renz 2024; Schiefner-Rohs et al. 2024). Education is in danger of being reduced to imparting economically utilisable knowledge and instrumental skills (Lederer 2014).

So instead of using AI systems to repair the existing education system, a much more comprehensive discussion should be held that is not just focussed on alleviating the symptoms. The basis for this is a concept of education that is not narrowed down to economic benefits but includes general background and orientation knowledge that relates to the process of digitalisation as a whole. Such AI Education must utilise the creative and reflexive potential of AI in order to promote individualisation and freedom in the learning process instead of restricting it (Ahlborn 2024). On the one hand, AI systems off er instrumental support and, on the other, a range of critical educational opportunities: The different answers they provide to very similar questions can be discussed and reflected upon, as can the purpose for which they are used.

To this end, interdisciplinary collaboration must be intensified to address the question of what the architecture and relevance of digital systems (see also Schulte and Budde 2018) are and what implications this has for pedagogy and didactics. It should also be clarified which pedagogical and didactic questions teachers have that have not yet been answered. This concerns the use of AI systems in teaching and learning processes, for which it is not advisable to give generalised recommendations for action. The reliability of the systems' answers seems to depend very much on the topics and also very much on the individuals. Every now and then they respond with hallucinations. A critical approach to sources, which has always been important, is becoming even more relevant and at the same time more complex as diversification increases. To deal critically with sources is also an original task of AI Education.

Thesis 4: AI Education should incorporate the guiding principle of sustainable development for normative orientation and evaluation of the goals and consequences of the social use of AI

AI education is complex and interdisciplinary, but it is not enough to stop at describing the technologies. It is also crucial to promote the ability to actively shape and critically reflect in order to ultimately address questions of responsibility in the context of global developments. This is closely linked to education for sustainable development (ESD) in order to empower learners to ultimately overcome global challenges and to support sustainable, responsible shaping of the future (Weselek et al. 2022).

AI systems have transformative effects on many areas of life, including the economy, society and the environment. Although they off er opportunities for optimising resource use, energy efficiency and environmental management, they also have negative effects, such as high energy consumption, increased social inequalities due to bias in decision-making processes or the creation of precarious forms of work (clickworking), which further fragments labour markets and social structures (see also Hagendorff 2022; Tedre et al. 2020).

The guiding principle of sustainable development provides orientation for recognising and evaluating the complex interactions between technical innovations and the global goals for sustainable development, such as climate protection, social justice and resource conservation, and for acting accordingly (Sonnet et al. 2025). By integrating ESD into AI education, learners can be enabled not only to use AI systems efficiently, but also to evaluate their impact on the environment and society in a reflective manner and to understand themselves as a (small, local) part of a global and comprehensive AI ecosystem: Your own interaction behaviour contributes to the central collection of data and its evaluation possibilities. Political participation and co-determination in the processes that are influenced by AI systems are essential to ensure that AI is used for the benefit of all and does not just serve the interests of a few players. The fundamental point of reference for these reflection and design tasks orientated towards the value of sustainability is the question: How do we want to live in the future? By integrating ESD into AI education, a comprehensive educational approach is pursued that harmonises technological innovations with the goals of a sustainable and just society.

Thesis 5: AI Education plays a central role in informatics education by promoting the combination of creative-formative and analytical-interpretive processes and thereby demonstrating architectural and relevance perspectives.

In informatics lessons, it should be made tangible that the development and utilisation process of AI systems is influenced by goals, values and norms. The aim of teaching should be to give young people direction by actively helping to shape socio-cultural processes. However, this has not yet been the focus of informatics education.

One, if not the central educational goal of informatics teaching to date has been the teaching of (computer science) modelling techniques to promote algorithm-based thinking or computational thinking (Mertala et al. 2022; Schulte 2009; Wing 2006). Here, a task is analysed and solved in such a way that someone else, including a digital artefact (a universal computing machine), can execute the solution precisely and reliably (automatically). A formal structure or architecture is designed that abstracts from unnecessary or unimportant contextual constraints. These classical algorithmic problem-solving skills are still important and a necessary part of informatics education.

However, this is not sufficient, as AI systems require the development of additional skills, which (Tedre et al. 2021) refers to as "Computational Thinking 2.0". Here, the solution to the respective task is found in a data-based training process. The machine seems to 'learn'. The solution even appears to be emergent, as it is partially incomprehensible to humans and goes beyond what was intended. Its reliability and correctness cannot be guaranteed. Deterministic processing on pre-structured data is replaced by random processes on unstructured or semi-structured data, the quality of which can only be assessed in the respective context. The largely context-free approach that has prevailed to date has always been problematic because it means that the question of relevance, the appropriateness of the solution and the evaluation of effects in the application context can only be posed as an appendage. It is proving difficult to integrate such reflections and evaluations systematically and in a well-founded manner into the teaching and learning processes of computer science lessons. One reason for this is that different ways of thinking (mathematical vs. philosophical, political) do indeed clash.

Though, when considering AI systems, which are inscribing themselves even more deeply into all areas of life than before, dramatic effects and transformations seem to be emerging, meaning that questions of relevance can no longer be ignored. The very processes in which they are created explicitly or implicitly incorporate values that must be regarded in the evaluation of the systems. This applies in particular to the selection of training data, which may even perpetuate discrimination. Ethical questions must also be integrated (cf. Becker et al. 2022; Verständig 2024). The questions about values concern individuals and their usage processes. Beyond that, they also concern the socio-cultural context in which rules must then be found. Methodologically, the individual and socio-cultural relevance of AI should be discussed from the perspective of use. But one should not stop at such analytical questions. Overall, a design-oriented informatics education should be aimed for (see also Schulte and Knobelsdorf 2011; Schulte et al. 2017).

Thesis 6: AI Education not only encompasses individual knowledge and reflection, but also enables social participation, co-determination and co-design in the social sphere. AI Education is always also political.

AI Education is not limited to functional qualifications and individual skills, but includes dealing with uncertainty and insecurity and requires the creation of open spaces of possibility (Gapski 2021; Verständig 2023). AI Education also concerns questions of the underlying view of humanity and the world, of freedom and self-determination in a digital society. The realization of maturity, emancipation and autonomy (Verständig et al. 2022) is closely linked to political framework conditions and political action (Coeckelbergh 2022). The practical educational answer to the question of what can be done includes reflection on socio-political effects, empowerment for digital political participation and awareness of the need to help shape digital technological developments (Dander 2023). As described above, the goals of sustainable development should be included in the normative framework of AI education.

Artificial intelligence in education requires the development of an integrative and interdisciplinary approach from various fields of knowledge, critical reflection and practical skills. As outlined in the theses above, background knowledge from informatics about data and algorithms must be combined with economic insights into the data economy, ethical reflections on discrimination, psychological knowledge about human manipulability, legal and practical data protection knowledge and political knowledge about the regulation of AI. In addition, the individual-personal level of self-development through personality development and the promotion of critical thinking must be included: How do I position myself based on which values and by means of which actions on the consequences of certain AI systems?

The implementation of AI Education must not stop at these bundles of knowledge and the promotion of critical thinking, but must also include the social and societal level of action and the empowerment of political action in the digital world. Different levels of this empowerment can be distinguished and illustrated with relevant questions:

1. Individual level: How do I express my consent or refusal to the use of my copyrighted works for the training of generative AI? Which techniques of control over my data are useful? What reporting points are there for algorithmic discrimination? How can I improve critical evaluation skills for AI-generated content? How can I adapt AI systems for my own purposes?
2. Communicative-participative level: How do I become capable of communicating with developers of AI systems? What forms of data activism are there? How can I participate in civic technology developments?
3. Normative-ethical level: According to which guidelines and values should the future be shaped with AI? Which goals beyond those of education for sustainable development are relevant? What do these developments mean for our image of humanity and society?

In practical implementation, there are common fields of action between informatics, media education and political education in order to promote critical-reflective public spheres, socio-political participation and the responsible co-design of AI.

Concluding remarks

With this thesis paper, we aim to offer theoretical and practice-oriented impulses from various disciplinary perspectives to advance work in the field of AI and education. To this end, we have deliberately argued at an abstract level in order to highlight the complexity of the interactions. The depth and breadth of the knowledge domains that must be integrated across perspectives still need to be explored and translated into concrete, target group-specific educational measures. Our goal is to stimulate and foster this broader discussion.

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