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Education in the Context of Digitalization and AI. An Overview of Key Moments and Effects

Abstract: This paper gives an overview of the effects of digitalisation, AI and Generative AI in the last ten years, in the field of education. The aim is to trace and highlight the key aspects and major moments that produce direct and indirect, positive and negative effects in this field. The first part synthetises how education looked like before Covid-19 pandemic. The second part presents two major and still present problems, generated by the usage of Chat GPT. Finally, the last part draws the contour of a big scheme in education, which might improve the present situation, in the context of Generative AI.
Keywords: AI; Education; Generative AI; Chat GPT; Digital Literacy; Adaptive Teachers; Assets.

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Some of the most discussed, analysed and criticised topics in the last years are, for certain, related to the developments of intelligent technologies: digitalisation, artificial intelligence (AI), and the way in which the contemporary society is influenced by them. Various parts and aspects of society had to be adjusted, at least partly, to the changes brought by the rapid digitalisation and almost unpredictable challenges and effects of AI.

This paper explores the alterations in the field of education, in the last ten years. More accurately, we analyse the period between 2015-2025, five years prior the Covid-19 pandemic[1], and the following five years, which facilitated and accelerated the advancements of intelligent technologies, with the purpose of highlighting the contrasting attitudes regarding the changes brought by AI and digitalisation. The fact that intelligent technologies have faster advancements and deeper effects than other previous technologies has already been stated by many scholars and researchers in the field of education[2]. But in the last couple of years, the changes were reportedly

more radical, had many negative results – in senses that will be elaborated in this paper – and the so-called enthusiasm towards AI that has gradually faded away for numerous scholars[3]. The main reason is the appearance of Generative AI (GenAI). A few of these changes, direct and indirect effects and some possible solutions to the present problems and concerns in education will be traced in this paper.

The present work is divided into three main parts. The first one, *Digitalisation and AI before 2022,* synthetises and analyses how digitalisation and AI were perceived by teachers and scholars in the field of education, including higher education (HE). The second part, *Generative AI in education: cheat codes and critics*, traces the changes and challenges of Generative AI in education, its positive and negative effects, as they were perceived by the subjects that are acting in this field. The third part, *No AI in education?*, explores the proposed solutions of the researchers who consider Generative AI harmful for education. With this structure, the paper has the scope to build an overview of the changes in attitude towards AI in education and to establish a few key aspects and moments during the previously mentioned period.

Before proceeding, there is a need for clarification of some of the main terms that will be used in this work, while some are also relevant for a deeper understanding of the general use of AI in education. AI is an umbrella term that designates a wide range of technologies based on algorithms, such as deep learning, robotics, machine learning and rule-based AI etc. The last two types of AI mentioned are the ones most often used in this field[4], at least until the appearance and emergence of Generative AI.

Briefly, machine learning AI refers to the algorithms that "are designed to mine large datasets to uncover – or 'learn' – latent rules and patterns that may help inform some future decision"[5]. In education, this type of AI is usually used for making different types of reports and appraisements based on large groups of students. Machine learning systems are put in use for their capacity to "'predict the future' – often in the form of early 'warning systems'"[6]. In this way, some results can be anticipated: for instance, the evaluation of the students can be optimised, they could be encouraged to study more advanced classes or light could be shed on aspects that need to be reviewed in class or in particular study[7].

According to Nabeel Gillani's remarks, rule-based AI is not as complex as machine-learning AI. It operates big datasets, but "computers manipulate data based on a set of pre-defined logical propositions, instead of ones inferred from patterns in the data"[8]. In comparison to machine-learning AI, which was used more frequently in the last years, rule-based AI can be easily limited, if it does not use a complex set of strategies. Though, both systems can be upgraded accordingly to the present advancements of AI, in conformity to the tasks they must complete[9]. Also, rule-based AI models are used for administrative and logistical purposes in educational institutes[10].

1. Digitalisation and AI before 2022

Why does 2022 appear to be a border, or to mark a different period in comparison to the years that followed it? Does it contain a significant modification? What has shifted then? In 2022,

Generative AI has gained, almost instantly, plenty of attention. A key moment in the development and spreading in use of Generative AI among the big mass of population, especially in the Nordic hemisphere of the planet[11], is the autumn of 2022, when Chat GPT was launched. Shortly after this moment, Generative AI quickly found its way into the field of education. Before this, in 2020, when the Covid-19 pandemic started, most of the world was forced to get familiar with intelligent technologies and most of the fields were brutally obligated to temporarily digitalise themselves. This moment was the trigger for the digitalisation, although this process had indeed started a few decades earlier. Even though in some parts of the world AI was already in frequent use in the field of education, during the Covid-19 lockdown the process was rushed, and the effects were hardly anticipated.

Even if this happened due to a critical moment at a global scale, it had amplificated even more the enthusiasm towards what AI could become in the future and what the world will look like in a couple of years[12]. Seeing the rapidity of updates of the big companies (such as Google, Microsoft, Apple etc.) and their ability to adapt to the challenges imposed by rapid digitalisation, many scholars have kept their curiosity and enthusiasm[13]. But the concerns started to appear soon, and the scepticism of some was justified and rightfully kept when unpredictability started to be the most specific and definitive characteristic of AI. After the emergence of Generative AI, these tendencies grew even more.

In 2024, Janja Komljenovic *et ali* remarked the way in which the governments have used their power in the field of education, and not only. The authors have observed that in the last five decades, the HE governance has gone through some radical shifts and one of them is the marketisation. Specifically, the HE became more bounded and recently dependent on technology – this is also true, at least partly, for the years prior to the pandemic in the early 2000's: in 2015, for instance, some aspects of education were already deeply intertwined with AI. In other words, HE has been digitalised "often with proprietary technology, leading many to describe this development as a form of marketisation and commodification of HE"[14].

Noteworthy, the authors emphasize K. Pistor's remarks, from an article published in 2020, regarding the importance and the lack of transparency of the contracts between HE institutions and the big companies that provide the technology that is used in education[15]. Consequently, the process of digitalising education – or HE in the sense used by the mentioned authors – has, mainly, a double scope: one is to amplify the developments of the systems of education, the second is to create a network of contracts with diverse companies. Along with the aspects mentioned above also comes the assetisation[16], which gives the assets' owner economic benefits on long-term and a sort of control over them: "assets are protected by legal arrangements, such as copyrights, intellectual property rights, and patents"[17]. There are many elements that have similar features of assets, and in HE, assets refer to courses and course materials[18].

At this point, it is inevitable to see how deeply AI has changed the entire system of education. The group of authors mentioned above, and many others,

have noted not only the way in which the changes are visible, for example, at the level of equipment[19], but even at the core of educational systems. A digital infrastructure has already been established, which has, for sure, changed even the relations among teachers and students[20]. Even though these technologies have the scope to enhance the conditions and the quality of education, or to optimize its functionality, they have produced deep and irreversible changes. When those aspects became problematic, the attitudes of scholars and researchers in this field have changed suddenly.

2. Generative AI in Education: Cheat Codes and Critics

The enthusiasm for AI has drastically decreased and the scepticism and critics towards it have raised with rapidity since Chat GPT became available on the internet. Why? The answers may vary, but the negative effects are, for certain, more numerous than the positive ones. The unpredictability of the advancements of Generative AI leads to many questions and difficulties in education, and the rapidity of its updates does not leave enough time for the educational institutions to adapt properly. Once Chat GPT was launched in the autumn of 2022, the field of intelligent technologies has found a quicker and easier way to change, almost entirely, some domains. Many experts in the field of intelligent technologies agree that this happens due to its capacity to operate with huge datasets and its ability to "learn" from previous tasks received from its user. The ability to search in just a few moments through huge digital libraries, for example, has given Chat GPT an excellent way in which it could easily be integrated in education.

Since then, the past of AI seems to matter less than its present and its future, because the intelligent technology has taken a radical change and cannot be measured anymore with the previously used tools[21]. Also, Neil Selwyn has argued that when it comes to AI – and Generative AI fits in this context[22] – it is more correct to look at it as something that lacks history[23]. Because the current situation does not have an equivalent in the past, for teachers it is harder to manage its usage and effects. Following this line of thinking, the attitudes of teachers and researchers in the field, towards Generative AI, implicitly Chat GPT, could not remain the same. Actually, enthusiasm towards AI is at the opposite pole of the attitudes regarding it.

Why has this platform brought upon itself so many negative opinions? In short, this platform is mostly used for cheating. For instance, when given an assignment of a five-page essay, many students use this platform or other tools to write it, partly or entirely. This is a phenomenon visible and confirmed by the published statistics of Chat GPT. Some reports show that more than 80% of students in universities use platforms such as Chat GPT, Grammarly or Microsoft Copilot etc. during semesters[24]. Grammarly, for example, is usually used to improve the quality and the language of texts. But a question arises here: how authentic is the final work in these conditions? Chat GPT might also be helpful for suggestions and for synthesis of large amounts of data, but if a student submits an essay which contains clearly formulated arguments and correct information, though enhanced with this platform

or written and formulated by it, can that essay still be eligible for grading? If the students did not receive a specific task in which they have to work with any of these platforms, the answer is negative.

In short, this is the main problem with Generative AI. Even though it was not designed to encourage students to plagiarise their papers, this result is inevitable. The free usage of such platforms brings ethical problems in education[25]. Before the release of Chat GPT, the ways of cheating in writing essays, for example, were limited and not so grave. With weak regulations regarding the usage of AI, more particularly Generative AI, students continue to use it.

Besides the cheating in writing essays – the issues generated by Chat GPT are also visible in other tasks, but this is the most pertinent and relevant example – Generative AI created another major problem: it diminishes fundamental skills that are developed in school, such as creativity, critical thinking or comprehension, because it creates, in time, the habit of relying solely on AI tools, and the students' input decreases[26]. In this way, their papers are no longer their own work, only in a small portion, and the skills that are exercised through this kind of task are not developed anymore. So, from a cognitive perspective, Chat GPT has generated many negative opinions regarding its results on long-term[27].

The problem of authenticity might be solved via implementing more rigorous laws, as we will see in the next section of this paper. However, it will take some time and, as we asserted earlier, AI moves faster than educational institutes. Plagiarism and, therefore, the lack of academical integrity are some of the most serious problems in education since the emergence of Generative AI. These are the effects of using platforms – such as Chat GPT, Grammarly etc. – and it seems less likely to disappear entirely even if educational institutions totally forbid any usage of them. The students will continue to use it in one way or another. Considering these aspects, the problem of Generative AI, specifically Chat GPT, is complex and its developments continue to add other layers.

The two issues discussed above are not the only ones, but they are the major ones. They are deeply intertwined, so it is exceedingly hard to even get a partial control over it. The educational institutes face some unprecedented problems, which are rapidly changing their infrastructures and their entire system. In these conditions, the future seems unsure and unpredictable, and the negative attitudes towards Generative AI and any other form of AI in education are rightfully motivated[28]. Noteworthy, Generative AI may have some positive aspects, such as easier and quicker access to information or personalised learning, but its entrance into the field of education is a "double-edged sword"[29]. As a whole, it raises countless contrasting opinions and critics. Can Generative AI be introduced in education? Would it be beneficial to introduce more types of AI?

3. No AI in Education?

No AI in education? At this moment, it is almost impossible to imagine the education system without any form of AI. A more pertinent question is: how should the education look like to enhance the positive aspects of the usage of AI? And what needs

to be changed in order to diminish the major problems caused by Generative AI? In any realistic future scenario proposed by scholars in this field, AI does not simply cease to exist, but its usage suffers modifications.

As was mentioned in the previous section, the problems of plagiarism can be solved by implementing a new set of laws regarding the usage of Chat GPT, for instance[30]. Establishing which platforms can be used and how to use them would be helpful in this sense. For certain, it is a complex process, and this is only one small part of this huge scheme of changes that are in urgent need in the education system. In this context, digital literacy is highly needed. Besides it – which implies some key dimensions such as digital tool proficiency, critical information evaluation, technology ethics implementations etc.[31] – we also need to make sure that technology does not replace the teachers, or that AI does not become more important than them. Instead, AI should be integrated as something that helps the teachers and students, something that enhances the processes of learning and research[32]. Also, this entire scheme requires adaptive teachers[33], but this brings the discussion back to the point of the disproportions between the time that is needed to implement changes in educational institutes and the rapidity of advancements of AI.

Another premise which also devolves from this point is the process of integration of technology in education – even though technologies evolve quickly, their integration takes much longer[34]. The introduction must be done gradually, so the changes are not so sudden; on the flip side of this, the students will still have the tendency to use technologies that are more advanced than the ones present in their school or university. However, if they keep the pace with all those changes, ethical regulations might still be able to control the use of AI, at least partially.

With all of these, Selwyn redraws the attention to the unpredictable nature of AI and of its implementation in education:

> We have seen that there is little historical reason to assume that technology use leads to inevitable and sustained educational improvement. Instead, there is plenty of evidence to suggest that the implementation of technology in education is rarely a predictable or controllable process[35].

In the big scheme of adapting education to AI implementations, there are many key points and premises that require special attention, as well as a perfect coordination among the teachers and students. The integration of AI in this field is no longer an option[36], it is necessary for an optimal operation and a progress in techniques and research.

To sum up, AI, respectively Generative AI, brought unprecedented changes in education as well as an unpredictable future. The tools that were used before are implicitly outdated and new methods are required to still have a qualitative education in the future. The appearance of the enumerated problems and solutions gave birth to new directions of study in this field. Still, a good and consistent theorisation of this phenomenon is required and needs to be actualised often. AI and Generative AI possess the means of complete alteration in the educational field, but with the right attitude and measures of caution, the positive aspects might become more numerous than the negative ones.

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Notes

1. Many scholars rightfully consider the Covid-19 pandemic as the trigger moment for rapid developments in the field of intelligent technologies.

2. Such as: Neil Selwyn, *Education and Technology Key Issues and Debates*, third edition, London, Bloomsbury Academic, 2022, p. 3, 11; Łukasz Tomczyk, Aleksandra Majkut, "Integrating AI in Education: An Analysis of Factors Influencing the Acceptance, Concerns, Attitudes, Competencies and Use of Generative Artificial Intelligence Among Polish Teachers", in *Human Behavior and*

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3. Neil Selwyn, *op. cit.*, p. 51, 63.

4. Nabeel Gillani *et ali*, "Unpacking the 'Black Box' of AI in Education", in *Educational Technology & Society*, vol. 26, 2022, p. 100, https://www.researchgate.net/publication/366874907_Unpacking_the_Black_Box_of_AI_in_Education, last accessed at 26.10.2025.

5. *Ibidem.*

6. *Ibidem,* p. 104.

7. *Ibidem.*

8. *Ibidem,* p. 102.

9. *Ibidem*.

10. *Ibidem*, p. 104.

11. Most of the reports and fieldworks regarding the effects and attitudes of teachers and students towards GenAI or simply Chat GPT have been conducted in this space. Still, there is a constant need for more reports and fieldworks, in order to have a complete and nuanced overview of this topic.

12. Neil Selwyn, *op. cit.*, p. 51, 63.

13. *Ibidem*, p. vii.

14. Janja Komljenovic *et ali*, "Digitalised Higher Education: Key Developments, Questions, and Concerns", in *Discourse: Studies in the Cultural Politics of Education*, vol. 46, nr. 2, 2025, p. 279.

15. K. Pistor, "Rule by Data: The End of Markets?", in *Law and Contemporary Problems*, vol. 83, nr. 2, 2020, p. 101–124, *apud.* Janja Komljienovic *et ali, op. cit.*, p. 279.

16. *Ibidem.*

17. *Ibidem*.

18. *Ibidem*.

19. *Ibidem,* p. 282.

20. *Ibidem*, p. 282-283.

21. Neil Selwyn, *op. cit*., p. 49.

22. At the time of Neil Selwyn's book publication, Generative AI or, more specifically, Chat GPT had not been released yet, but we consider that it is right, in the context of this paper, to include Generative AI and Chat GPT in the category mentioned by the author.

23. Neil Selwyn, *op. cit*., p. 49.

24. *AI in Higher Education: A Meta Summary of Recent Surveys of Students and Faculty*, https://sites.campbell.edu/academictechnology/2025/03/06/ai-in-higher-education-a-summary-of-recent-surveys-of-students-and-faculty/, last accessed at 28.10.2025.

25. Irmawati Thahir, Nurasia Natsir, "Becoming an Adaptive Teacher: Technology Literacy and Ethics in the Digital Era", in *Proceeding of the International Conference on Social Sciences and Humanities Innovation*, vol. 2, nr. 1, 2025, p. 1-13, https://prosiding.appisi.or.id/index.php/ICSSHI, last accessed at 28.10.2025; H. Niemi *et ali*, *AI in Learning: Designing the Future*, Cham, Springer Nature Switzerland, 2023, p. 6.

26. M. Farinosi, C. Melchior, 'I Use ChatGPT, but Should I?' A Multi-Method Analysis of Students' Practices and Attitudes Towards AI in Higher Education", in *European Journal of Education*, vol. 60, issue 2, 2025, online publication, https://doi.org/10.1111/ejed.70094, last accessed at 29.10.2025.

27. *Ibidem*, p. 2-3.

28. *Ibidem*, p. 8.

29. *Ibidem*, p. 3.

30. Irmawati Thahir and Nurasia Natsir, *op. cit.*, p. 9.

31. *Ibidem*, p. 4-5.

32. *Ibidem*, p. 6.

33. In Irmawati Thahir and Nurasia Natsir, *op. cit.,* the authors build their work around the concept of "adaptive teacher", which designates, in short, a set of abilities, skills and knowledge of a teacher

which qualify the teacher to work in conditions that require drastic changes, such as the integration of AI in the entire educational system.

34. Neil Selwyn, *op. cit.*, p. 51.

35. *Ibidem*, p. 66.

36. Irmawati Thahir and Nurasia Natsir, *op. cit.*, p. 10.