INSTITUTE OF PUBLIC POLICY

LISBON

REPORT 11

Generative AI and Higher Education: Challenges and Opportunities

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Contents

1. Introduction[1]

Generative AI (GenAI) became a worldwide sensation in late 2022, with the public release of ChatGPT. Soon students, educators, teaching assistants, and university administrators grasped the potential of instruments such as chatbots in higher education (HE). While some foresaw the end of classical teaching via substitution by AI assistants, others understood the transformative potential of GenAI in shaping and enhancing education to everybody's benefit.

GenAI can provide students with quick summaries of educational materials, help teachers prepare their classes and grade their students' exams, as well as reorganise the entire academic curriculum and teaching approach for future students based on an analysis of previous and incoming students' data. However, GenAI brings other possibilities to the table. It does not simply curate information or summarise many sources into one usable and easily accessible document for humans, it also generates new content. This content may assume the form of human-like text, image, video, sound, software, or anything the GenAI technology can collect data about. It is indeed the GenAI technology of Large Language Models (LLMs) that is behind every AI chatbot such as OpenAI's ChatGPT, Google's Gemini, or Microsoft's Copilot. Other types of AI ("big data") will also play their part in developing higher education, namely due to their capabilities to analyse large data sets and find patterns. For instance, an AI-powered analysis of student data, such as their age, gender, or previous school grades, among other performance-related data, can help universities better grasp the roots of old educational problems such as dropouts, unequal opportunities arising from external factors, or outdated curricula.

If left to chance, these new possibilities may also lead to abuse. There is a double need to prevent the misuse of GenAI and to use it to enhance students', teachers' and every HE actor's performance and integration. The European Union has already produced various policy documents. The *Living guidelines on the responsible use of generative AI in research* (European Commission, 2024)[2] suggests guidelines for research, which can be extended to higher education more generally. Examples are the obligation for researchers to mention the use of AI in their research (similar to in-class activities/evaluations carried out by teachers using AI); avoiding the predominant use of AI in tasks that impact other

[1] This report is a work in progress and comments are welcome. We would like to thank Google for supporting this research, and ISEG (University of Lisbon) for supporting Institute of Public Policy. The cover image was produced by ChatGPT.
[2] https://research-and-innovation.ec.europa.eu/document/2b6cf7e5-36ac-41cb-aab5-0d32050143dc_en

researchers (e.g. peer reviews) may be justified on the same basis as, for example, the obligation for teachers not to subject their students to 100% AI-managed evaluations.

The *Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for Educators* (European Commission, 2022)[3] refers to four main domains where AI and Data can be used in Education (student teaching; student supporting; teacher supporting; and system supporting) and provides thirty-six *Guidance Questions for Educators* regarding human agency and oversight; transparency; diversity, non-discrimination and fairness; societal and environmental well-being; privacy and data governance; technical robustness and safety; accountability.

Other institutions have produced policy documents (OECD 2023, UNESCO 2023, 2023a) addressing the issue of the impact of AI in education and research. As GenAI develops, the number of papers published on the topic increases exponentially, and so does the number of higher education institutions that produce either regulations on AI use or guidelines for educators and students.

This report aims to give a brief overview of the impact of GenAI on higher education namely in three main dimensions: educators (Section 2), students (Section 3) and higher education institutions (Section 4). Our focus is on the main opportunities and threats associated with GenAI to minimise the risks and fully take advantage of the opportunities.

We faced two difficulties in composing this report. One is that the GenAI is a moving target. We know what it is today and which are its available applications (LLMs, image /sound / video generators, editing tools such as Grammarly, bibliography management tools such as SciSpace), but do not yet know its future incarnations and uses. The other difficulty is that we would like to refer to a shared understanding about the mission and core values of Higher Education Institutions (HEIs). For example, plagiarism is certainly a threat because academic integrity is a shared core value. The identification of and trade-offs between threats and opportunities depends on our focus on certain core values.

The first difficulty is unsurmountable. The only certainty we have is that the questions we address in this paper will have different answers in a few years as GenAI develops and new applications emerge. As for the second, we will mention a set of core values throughout the paper, raise questions, and present our answers and recommendations in Sections 5 and 6.

[3] https://op.europa.eu/en/publication-detail/-/publication/d81a0d54-5348-11ed-92ed-01aa75ed71a1/language-en

The following questions are among the most relevant raised by the development of GenAI:

- Will GenAI change the mission of higher education institutions?
- How to safeguard the irreplaceable value of human educators even under widespread use of GenAI?
- How is Gen AI changing the role of teachers and teaching assistants?
- What are the likely changes in assessment techniques to be effective, ensure integrity and discourage plagiarism?
- Can we expect that new efficient AI applications will detect plagiarism?
- What are reasonable and unreasonable uses of GenAI in the assessment of students under transparency about its use in evaluation?
- If GenAI allows teaching personalized to each student's progress, should or can a common grading scale be maintained?
- How to promote the ethical and responsible use of AI outputs by the academic community?
- Should we introduce AI literacy in all curricula, irrespective of the field of study, but adapted to each field?
- How to best transmit to students how data biases influence AI outputs?
- How to reduce individualism and promote social skills and critical thinking?
- Should guidelines for ethical and conscious use of Gen AI be set at a university level or (and) at a school/department level?
- How to protect students' data and privacy?
- How to promote equal opportunities in the access to AI tools to students with more vulnerable socioeconomic backgrounds?
- What is the optimal level of stimuli to students (e.g., notifications and nudges) to promote engagement and motivation, while avoiding loss of autonomy and self-esteem?

It is beyond the scope of this report to answer the first question, which is a fundamental existential question of higher education institutions not much addressed in the literature. However, we will address all the other questions in this report.

2. Educators: Teaching and Evaluation Methods

"One recent study found that in the 20 occupations most exposed to AI language modelling, there are 14 teaching subcategories including English language and literature, foreign language and literature, and history teachers" (Felten et al., 2023).

The impact of GenAI on teaching is expected to be immense and diverse. It will certainly depend on the learning area, as the above citation indicates. Still, regardless of the area, it will undoubtedly transform the possibilities educators have to engage with their students and motivate them to learn.

At the level of opportunities for educators, one can identify three main domains: the preparation of class materials, teaching attractiveness, and evaluation of students' work, where the latter faces new challenges due to students' (mis)use of AI. Concerning the risks, the quality of AI system outputs is not guaranteed, may not be in line with educational goals, or may contain biases. Educators will be responsible for overseeing and avoiding these issues.

Additionally, educators will have to develop evaluation methods consistent with students' use of GenAI and permanently be aware of its growing capabilities. HEIs and their educators have indeed started to respond to the availability of GenAI. This adaptation first resided in substituting evaluations where students can misuse AI without detection, such as take-home exams, for classical real-time evaluations, such as written exams or class presentations. However, this is a purely defensive move and will often not be feasible due to time constraints. The next step is to actively exploit the capabilities of GenAI to improve both teaching and learning. This cannot be left to each educator's initiative and resources: HEIs must offer active support.

2.1. Findings from the Literature

The rapid integration of GenAI into educational settings is reshaping curriculum design and pedagogical approaches. In a recent study, Lee et al. (2024) formed a Community of Practice (CoP) among the University of Adelaide's staff and students to collectively discuss issues surrounding AI. Half of the participants indicated they had modified their course designs due to GenAI. A prevalent change involved assessments, with many participants mentioning the use of varied assessment methods, the introduction of new assessment questions, and tasks focused on the application of knowledge. Additional adjustments

included altering essay topics to emphasise fieldwork and using AI to create low-quality drafts that students were then asked to improve.

Although most AI-enabled adaptive learning systems and frameworks are still in an experimental phase, they have seen growing interest and use since the pandemic (Kabudi et al., 2021), particularly to improve pedagogy. These systems can enhance teaching and offer individualised assistance by accurately matching the specific learning goals and criteria for the success of the course or instructional unit, allowing educators to "tailor educational content to the distinct needs, interests, and learning preferences of each student, offering personalised learning materials and activities" (Labadze et al., 2023).

Two prominent applications of GenAI in education are Intelligent Tutoring Systems (ITS) and Chatbots. The first use AI techniques and educational approaches customised to students' specific characteristics and requirements (Mousavinasab et al., 2018). The second are AI-driven conversational agents that interact with students through text or voice interfaces. They can answer questions, provide explanations, and guide students through various learning activities (Lin et al., 2023; Memarian & Doleck, 2023).

GenAI may promote learner engagement through adaptive personalized recommendations (Maravanyika et al., 2017). Padron-Rivera et al. (2018) propose the affective tutoring system Tamaxtil, designed to detect when students become frustrated and confused and adapt the learning experience to the student's emotional state.

Concerning exam preparation and correction, GenAI has been found to transform educators' work loads and capabilities to do either. Yang et al. (2021) reported that it can generate questions and create multiple-choice tests. Additionally, Lu et al. (2021) studied the use of natural language processing to create a system that automatically created tests and found that AI technologies can generate highly reliable short-answer questions. Although not pure GenAI per se, AI-powered automatic assessment reduces grading time (Crompton & Burke, 2023; Rutner & Scott, 2022). Nonetheless, GenAI's capabilities are essential to provide detailed and personalised feedback on those assessments.

After the launch of ChatGPT in November 2022, both students and educators were taken in by the quality of the chatbot's text outputs. Many educators were also immediately concerned with the need to weed out GenAI-driven plagiarism. The literature on this issue stresses the fragility of the existing mechanisms to detect AI-generated text, arising from the difficulty of differencing the latter from human-generated text (Elkhatat et al., 2023). Not only do AI-generated texts (such as those produced by ChatGPT) go unnoticed by AI detection tools (Weber-Wulff et al., 2023), but studies have found that

these detection tools have too many false positives and false negatives (Dalalah & Dalalah, 2023), which may undermine HE core values such as trust and integrity.

2.2. Use Cases

2.2.1 Course administration

From the educators' perspective, GenAI can play a pivotal role in preparing courses and establishing learning goals. GenAI tools, such as AI chatbots and ITS, offer numerous advantages that can significantly enhance the educational process. For instance, ITS can assist educators by measuring students' comprehension, proposing suitable teaching approaches and techniques, and offering assistance and direction to both students and educators (Zawacki-Richter et al., 2019).

Well-designed GenAI systems can further aid various aspects of course preparation by offering a wealth of resources, making learning materials easily accessible, and offering expert guidance on challenging subjects (Ilieva et al., 2023; U.S. Department of Education, 2023; UNESCO, 2023a). Additionally, they can assist with routine administrative tasks associated with university courses (OECD, 2023). For example, if correctly trained, AI chatbots could efficiently manage common student inquiries, schedule office hours, and distribute course materials (Ilieva et al., 2023).

By managing these tasks, GenAI tools could allow educators to focus more on critical aspects of teaching. In fact, according to Ilieva et al. (2023), the most important decisions related to instructional design, assessment methods, and overall course management must be retained by the educator. Human supervision guarantees that the course content remains permanent and accurate. Educators can use insights from AI tools to make informed decisions while maintaining their essential role in the educational process (Felix, 2020).

2.2.2 Preparation of classes and study material

In the context of class preparation and study material, GenAI can be an asset. For example, educators can use it to record classroom sessions and obtain metrics related to student engagement (U.S. Department of Education, 2023). If students spend a significant amount of class time talking to each other, the educator can analyse this behaviour to understand its underlying causes: Is the content too difficult? Is it too boring? By

identifying the reasons, educators can develop targeted approaches to address these specific issues, enhancing the overall effectiveness of their teaching.

In addition, GenAI tools can be used throughout the class itself. According to OECD (2023), AI tools can be used to augment cognitive engagement, by supporting educators in (i) generating multiple representations, (ii) adapting to more meaningful contexts and (iii) providing numerous opportunities to practice.

Specifically, in (i), the educator can recur to text, graphics, or models to help students make deeper connections and achieve a thorough understanding of the content. GenAI can support this by providing diverse explanations, allowing students to evaluate and contrast different viewpoints, which can enhance their comprehension. In the context of (ii), educators can create a more adaptable bank of instructional resources, generating them spontaneously to address the interests of distinct groups of students. This would ensure that the learning materials are relevant and engaging to all students. Finally, in (iii), through repetitive practice, students develop fluency and the ability to perform tasks quickly and effectively by repeatedly engaging in the same computations and processes. Educators can use GenAI to produce unlimited, customised practice exercises, offering targeted practice opportunities that address the specific difficulties students might face in each topic.

2.2.3. Personalization of learning goals and study materials

One of the most significant impacts of GenAI is on instructional design through personalised learning experiences. According to OECD (2023), educators can use GenAI to enhance various strategies for eliciting student thinking, providing feedback, and tailoring instruction to student needs. For instance, GenAI can quickly develop quizzes to assess understanding, offering detailed insights into student learning and helping with targeted feedback and interventions. It can also streamline feedback by generating comprehensive suggestions on assignments, identifying gaps in understanding, and suggesting improvements.

Additionally, GenAI (through learning analytics) can support differentiated learning by providing extra help to students who need it and simultaneously enable advanced learners to delve further into topics through self-directed learning (Kamalov et al., 2023; Zawacki-Richter et al., 2019; OECD, 2023). Specifically, learning analytics uses real-time data to evaluate students' progress, understand their learning methods, and track their self-regulated learning. It assesses performance, adapts the pace of new concepts, and

optimally reintroduces old content to refresh memory (Zawacki-Richter et al., 2019; OECD, 2023). Beyond supporting specific topics, it can guide students' learning trajectories, indicating when they are ready to advance.

An example of a tool that was designed to produce a feedback loop between teaching statistics and assessing student's progress is Stat-Knowlab, as described by de Chiusole et al. (2020). It adapts each learning experience to individual students' competencies and creates optimal learning paths. Applications such as this will help educators ensure that their students engage with educational activities suited to their current level of readiness.

2.2.4. Creation of exams and other forms of evaluation

Kurtz et al. (2024) emphasise the transformative potential of GenAI in the domain of student assessment. According to the authors, educational institutions still rely on traditional testing methods focusing on memorization and recall, neglecting the practical application of knowledge and skills. Moreover, while the call for transformative approaches in teaching and assessment is not solely a consequence of GenAI's emergence, the latter underscores the urgent need for these educational reforms.

One approach is through "AI-proof" assignments that use best practice teaching principles, such as breaking them into smaller tasks, designing authentic assignments with real-world value, incorporating space for student reflection and metacognition, and creating connections in content to experiences that AI lacks (e.g., recent events, classroom discussions). For instance, "AI-proof" assignments that were put into practice include generating sample texts or code and asking students to fact-check, critique, and improve.

Integrating AI into evaluation methods themselves can take multiple forms. According to Ouyang et al. (2022), various studies predating the launch of LLMs had already shown the benefits of automated assessment in online higher education. For example, Hooshyar et al. (2016) created an ITS Tic-tac-toe Quiz, designed to provide formative assessments for students' programming and problem-solving skills. Their research found that this system improved students' interest in learning, fostered positive attitudes, increased technology acceptance, and enhanced problem-solving capabilities. Similarly, Aluthman (2016) introduced an automated essay evaluation system that offers immediate feedback, assessment, and scoring for students in an online English learning environment. The study concluded that it significantly enhanced the writing performance of undergraduate students.

GenAI tools can further revolutionise formative assessments by offering advanced analysis and feedback capabilities (Celik et al., 2022). GenAI can evaluate student-created graphs or models, provide immediate feedback on complex skills, and manage simpler grading tasks, allowing educators to focus on more complex evaluations (U.S. Department of Education, 2023).

2.3. Main Opportunities and Threats

2.3.1. Opportunities

2.3.1.1. More granular assessments of students' level of understanding

Large class sizes can be challenging when it comes to assessing students' level of understanding in real time. It is not a question of evaluation, but of keeping and fostering the engagement of students with the content being taught. As mentioned in Section 2.2.3., GenAI may help educators by providing quizzes and diagnostic exercises, which can, in turn, provide more granular and precise reporting on what each of these students learned or is learning during a class. The level of monitoring reach and precision of GenAI outperforms the educator's (OECD, 2023). Following the above, in the future, GenAI can be an asset to measure students' level of understanding at two levels: the individual level and the class level.

At the individual level, educators can identify students who may be struggling with specific topics and intervene right away (Celik et al., 2022; Lim et al., 2023). For example, suppose a student persistently answers questions incorrectly. In that case, the AI tool can alert the educator, who can then provide additional support or adjust explanations to address the student's difficulties.

At the class level, GenAI can aggregate data to provide insights into overall class performance (Celik et al., 2022; U.S. Department of Education, 2023). Educators can use such insights to adjust their strategies, allocate more time to topics that students find challenging, and identify trends in student understanding. This could present a great opportunity to develop group activities and assessments, by pairing students who have mastered specific topics with others who have not yet reached the same level of understanding.

2.3.1.2. Teaching materials better suited to students' abilities and educational levels

Students differ not only in their knowledge level, areas of preference or grades: they also differ in the educational approach under which they learn best. While some require more direct attention, others work best as self-learners. While some prefer to follow the standard order of the contents, others find it better to have them reorganised. This, of course, is not the cause of all academic failure, but it would be naïve to think that these issues do not exist, that a one-fits-all approach to teaching is best where all students regardless of their capabilities and motivation must learn each content at the same time, at the same pace, with the same activities.

Challenging this conception, GenAI can guarantee a level of permanent adaptation to each student according to their skills, motivation, and their educator's educational goal. The times of anxiety of being left behind while not understanding or being bored of waiting for the class to move on to the next topic may soon be gone.

In addition, GenAI may also support and assist educators' judgement of each student's development by providing learning analytics. The data gathered in real time of each student's performance can inform their educator on what to study next and what set of exercises will help the student achieve the expected learning goals. Each time this analysis is performed, the educator will progressively have more insights and proposals on how to plan next year's curriculum.

2.3.1.3. Classes and exercises more interesting to students

As noted in European Commission (2022), "AR creates opportunities for teachers to help students grasp abstract concepts through interaction and experimentation with virtual materials. This interactive learning environment provides opportunities to implement hands-on learning approaches that increase engagement and enhance the learning experience." This rather dry description points to the benefits of supplementing academic abstraction with a plethora of real-life examples, to ensure not only that students learn, but also that they enjoy learning.

GenAI can train and test students in unscripted and highly realistic situations. Take the case of finance or economics. With GenAI, an educator could simulate a life-like real-time market situation where students could interact with each other and the GenAI mechanism in more ways than a classical game situation where all participants have a limited set of options. In medical studies, GenAI technology could reproduce a real-time simulation of a human liver (possibly complemented by virtual reality) that reacts with a

high level of accuracy to the medical student's actions. In both cases, GenAI would provide an unprecedented level of interactivity.

2.3.1.4. Educational materials for different languages or needs

By instantly translating and creating educational materials in different languages, as well as adapting them to the specific student's needs, GenAI technology allows educators to reach a more diverse group of students, making education more inclusive and accessible (OECD, 2023). Educators can quickly provide translated texts, lecture notes, and other multimedia learning resources, ensuring that students who speak different languages can access the same high-quality content as their peers (Farrelly & Baker, 2023). Similarly, educators can use GenAI to tailor educational materials to meet specific needs, such as converting text into audio for students with visual impairments and simplifying language for younger learners or those with learning disabilities (Pierrès et al., 2024).

This capability allows educators to make their teaching more effective and responsive to the individual needs of students. For instance, GenAI can convert complex texts into simpler versions for students with different comprehension levels, or create multilingual glossaries to support language learners. Moreover, in the future, it is also expected that more specific adaptations of educational materials for various disabilities will be created, covering a broader number of physical, sensory, cognitive, or learning disabilities (Pierrès et al., 2024).

In the previous Section, we mentioned that a combination with VR could be used to make challenges and exercises more interesting to students. However, it can also create immersive and interactive learning experiences that are particularly beneficial for students with disabilities. For example, virtual field trips can be an excellent resource for students with mobility impairments. Additionally, augmented reality can also be used to enhance visual and auditory enhancements to assist students with sensory processing disorders.

Finally, these technological advancements may also facilitate more collaborative learning and teaching across linguistic and cultural barriers by integrating global perspectives into course curricula (Kurtz et al., 2024). This integration can enrich the learning experience for a broader range of students in the classroom.

2.3.1.5. Less time spent on administrative tasks

"Schools and teachers can use software to perform many repetitive and time-consuming tasks such as timetabling, attendance control, and enrolment. Automating such tasks can allow teachers to spend less time on routine tasks and more time with their students [or preparing class materials or other educational approaches]" (European Commission, 2022).

Looking ahead, automating administrative tasks offers significant opportunities to enhance the educational experience. As AI technology advances, it will manage complex administrative functions more efficiently and accurately (Dai et al., 2023). This will free up educators' time, allowing them to focus on essential activities that directly impact student learning and development (Celik et al., 2022).

The reduction in administrative burdens also creates opportunities for more personalised learning experiences. As previously mentioned, educators can dedicate more time to understanding individual student needs and tailoring their instructional methods accordingly. Additionally, with more time to collaborate, educators can work together to develop interdisciplinary curricula that integrate diverse perspectives and skills, further enriching the educational landscape. By reducing the time spent on routine tasks, educators can focus on what truly matters: fostering a supportive, engaging, and dynamic learning environment for all students.

2.3.2. Threats

2.3.2.1. Shift in students' trust: Educators vs. GenAI

As GenAI tools become more integrated into educational environments, it is crucial to consider their impact on the dynamics between students, educators, and the technology itself. While these tools offer significant potential to enhance learning, they must be implemented carefully to avoid weakening the essential role of educators.

The development and implementation of GenAI tools must ensure that they enhance learning while not inadvertently harming students (Felix, 2020). If these tools are not used correctly or exacerbate existing issues in education, their use could significantly undermine trust in educators, both by students and their parents. Over-reliance on AI may even lead students to prefer AI tools instead of their educators or peers, specifically if the application seems to be more competent and to provide more immediate feedback than the educator or colleagues (Felix, 2020).

This potential shift in trust could have several implications. Strong relationships between educators and students are crucial for effective learning. If students start to rely more on AI tools, the personal connection that educators build with their students will weaken, leading to a less engaging and supportive learning environment. Additionally, over-reliance on AI reduces opportunities for students to develop critical thinking and interpersonal skills (Abbas et al., 2024). Educators not only impart knowledge but also foster discussions, debates, and interactions that are essential for holistic development. AI tools, while efficient, may not be able to replicate the nuanced guidance and encouragement that a human educator provides.

2.3.2.2. Insufficient technological means to detect plagiarism

Karl Popper observed long ago that "every solution of a problem raises new unsolved problems" (Popper, 1963). If it is true that AI could solve many current problems in higher education, it created several new ones, and hard-to-detect plagiarism is certainly one of them. If AI serves to both detect and avoid detection of AI authorship at the same time and with equal effectiveness, it will be a threat to higher education. It may even not just be a threat, but a transformative condition. As stated in the literature, AI tools and mechanisms to detect AI-generated text are far from fulfilling their mission accordingly, as there are many ways to avoid detection. Ibrahim et al. (2023) report that it does not need much to mislead ChatGPT-based tools to detect plagiarism, a few typos or full-stops can do the trick. The studies mentioned above (Dalalah & Dalalah, 2023; Elkhatat et al., 2023; Weber-Wulff et al., 2023) strengthen the idea that AI will not be enough to deter its use for plagiarism. Certainly, HE educators will have to adapt to this new condition. Until this happens, AI must be considered a threat to academic integrity and the achievement of the educational goals of HE in learning and research.

2.3.2.3. Ethical challenges in automating student evaluations

The ethical dimension of GenAI use in the evaluation and assessment of students' learning and achievement is especially important. AI systems' tendency for hallucinations and biases is well-known and justifies the requirement of "in-the-loop" presence of the educator in any AI tool participating in student evaluations. Additionally, GenAI systems may overlook and disregard other human factors that matter in the assessment of a given student, namely the learning process, the student's effort, and their participation in course work and classes. In other words, it seems clear that AI grading overlooks one educational

output that has been crucial to HE for a long time, which is the student's ability to "learn to learn." This does not mean that educators, therefore, must be forbidden to make reasonable use of any form of automatic evaluation. Rather, they will have to have the final word regarding the overall evaluation. We return to this issue in chapter 5.

2.3.2.4. Job Displacement: the potential of GenAI to automate teaching positions

As mentioned in the Introduction, recent research by Felten et al. (2023) explores how LLMs such as ChatGPT will impact various occupations, identifying post-secondary educators, such as those in English and foreign languages and literature, and history, among the most affected. These teaching roles are among the top 20 occupations exposed to AI-enabled advances in language modelling capabilities.

However, attention should be given to the fact that GenAI has the potential to automate certain teaching positions, particularly those involving repetitive or less specialised tasks. Maintaining the role of human educators is crucial due to concerns about the quality of education. Human educators should bring empathy, creativity, and a deep understanding of student needs—qualities that are difficult for AI to replicate (Chan & Tsi, 2023). Reducing contact with human educators could result in a more transactional form of education, diminishing the relational aspects that foster student engagement, critical thinking, and interpersonal skills.

One group that may be at particular risk is teaching assistants (TAs), who play a crucial role by aiding educators in teaching, grading, and administrative tasks in close contact with students. TA positions also serve as a significant source of financial aid, as well as valuable teaching and research experience, for graduate students pursuing advanced degrees. With GenAI systems' increasing capabilities to manage tasks typically carried out by TAs, there is a concern that these positions may become scarce. The replacement of TAs with GenAI has the potential to reduce the number of graduate students who can support their education through TA roles (Pence, 2019). This shift could have broader effects on the academic community, potentially shrinking the group of prospective educators and researchers.

2.3.2.5. Lack of transparency or explainability in AI systems

According to UNESCO (2023), "Artificial Neural Networks are usually black boxes; that is, […] their inner workings are not open to inspection. As a result, ANNs are not transparent or explainable, and it is not possible to ascertain how their outputs were

determined." This lack of transparency makes it challenging to detect biases in GenAI models. Furthermore, UNESCO (2023) emphasises that "If users do not understand how a GenAI system arrived at a specific output, they are less likely to be willing to adopt it or use it …."

Two concerns reflected in policy documents regarding GenAI for higher education are transparency and explainability. These concerns are especially important if one considers the educators' suggested role of oversight of AI systems used for classes. How can one oversee a "black box"? And what do educators need to know regarding GenAI to act upon these systems? For example, one may think of cases where biases are detected in the middle of a course with GenAI incorporated in its educational approach. How will educators be able to interact with or correct the GenAI system? AI systems skills will enter the European Framework for the Digital Competence of Educators4 of 2017, which is described as a "general reference framework to support the development of educator-specific digital competences in Europe". As did the other threats mentioned above, the role of educators will have to be rethought both in terms of desired educational goals and educational capabilities.

3. Students: Learning and Autonomy

The impact of AI on education is twofold, affecting both teaching and learning. He we explore how AI can enhance students' learning experiences. AI systems, particularly GenAI, have the potential to revolutionise learning by providing highly original and tailored responses to user prompts. Text-to-text AI generators like ChatGPT can assist students with their writing by enabling them to brainstorm ideas, receive feedback, and improve their drafts (Beck et al., 2023). Similarly, text-to-image AI generators such as DALL-E and Stable Diffusion are useful for conveying technical and artistic ideas, especially within the realms of art and design (Chan & Hu, 2023).

Since the release of ChatGPT, students have leveraged the capacity of GenAI to produce well-written text, often to bypass the effort of writing essays and assignments by themselves (Beck et al., 2023). While this might save time, it defeats the purpose of the evaluation exercise, which is to make students practice writing skills and assess whether they have developed their skills concerning the relevant subject matter. Too often, grading has focused on the quality of the text rather than the depth of understanding.

[4] https://joint-research-centre.ec.europa.eu/digcompedu_en

Nevertheless, students' use of GenAI capabilities should not be viewed only in negative terms. Using GenAI to produce ideas, structure and summarise arguments, and produce better and more imaginative text can be a vital skill set. Thus the challenge lies in finding the right trade-off and persuading students that relying solely on AI to complete their work short-changes their learning experience. Students must understand that while AI can assist in the learning process, the ultimate goal is to develop their analytical and critical thinking skills.

3.1. Findings from the Literature

The way students perceive their learning environment, their self-assessed abilities, and the instructional methods employed are important in shaping their learning strategies (Biggs, 1999). These perceptions can subsequently affect their educational outcomes (Chan & Hu, 2023): When students view their learning environment positively – covering aspects such as curriculum content, instructional methods, assessment techniques, learning resources, and support services – and feel confident in their abilities, they are more likely to engage in a deep learning approach. This approach involves striving for understanding and linking concepts. Conversely, students who perceive their learning environment negatively or lack confidence in their abilities tend to adopt a surface learning approach, which is characterised by memorization and meeting basic requirements (Biggs, 2011).

Understanding the broader implications of GenAI on student learning requires considering existing research on students' perspectives and experiences with these technologies. Recent studies have begun to shed light on how students perceive and use GenAI in the context of higher education. On the one hand, research has shown that students are welcoming the use of GenAI in their learning practices and future careers, while highly valuing its perceived usefulness in providing unique insights and personalised feedback (Chan & Hu, 2023). The same study reports a positive correlation between students' perceived willingness to use GenAI technologies and both knowledge of GenAI and frequency of use. On the other hand, students are concerned about the lack of clear policies on GenAI usage, AI bans in their institution, and unequal access to technology (Johnston et al., 2024).

Applying these initial perceptions and learning approaches to GenAI in higher education reveals that students' views, concerns, and experiences with GenAI can significantly impact how they use these tools and, consequently, the extent to which these

tools benefit the learning process. If students perceive GenAI as a valuable resource and feel confident in their ability to use it, they are likely to engage deeply with the technology, enhancing their learning experience (Kurtz et al., 2024). However, if they have concerns about access or unclear usage policies, they may adopt a more superficial or improper approach to using GenAI. This can limit its potential benefits in their education and lead to other consequences, such as reduced skill development due to overreliance (Abbas et al., 2024), academic integrity issues (Sullivan et al., 2023; Cotton & Cotton, 2023; Tlili et al., 2023; Memarian & Doleck, 2023a), inequality in access (UNESCO, 2023a), and overdependence on technology.

A recent longitudinal study on AI adoption in higher education conducted by Polyportis (2024) offers additional insights. The study tracked 222 Dutch students over eight months and found a significant decline in ChatGPT usage. Key factors influencing this change were trust (confidence in the technology's reliability, accuracy, and ability to perform), emotional creepiness (discomfort with human-like AI), and perceived behavioural control (belief in self-ability to perform tasks using the tool). Trust and perceived control over the technology positively impacted usage, while emotional creepiness had a negative effect. The study also underscores the importance of these factors in the sustained adoption of AI tools in educational settings.

Despite these concerns, the literature shows that GenAI tools can significantly enhance educational experiences across various domains. For instance, these applications can potentially deepen students' knowledge and comprehension by providing tailored educational experiences and helping them develop their writing skills (Beck et al., 2023; Kaharuddin, 2021).

Moreover, as discussed in the previous Section, these tools adapt to individual learning styles, making educational progress more personalised and effective. They provide continuous, real-time feedback, which is crucial for performance improvement. Furthermore, GenAI promotes active participation in the learning process, improves the capacity to assess information critically, and encourages inquisitive learning, strengthening critical thinking skills (OECD, 2023).

3.2. Use Cases

3.2.1. Personalised learning

The individualised approach provided by GenAI ensures that students receive appropriate support and challenges based on their proficiency (Mousavinasab et al.,

2018), which promotes autonomous learning and enhances the learning process and outcomes for students.

One notable example of an AI tutor system is Khan Academy's Khanmigo, a conversational AI tutor powered by GPT-4 and trained on the Khan Academy's learning content. Khanmigo supports real-time, one-on-one tutoring tailored to students' needs. It assists students by coaching writing, serving as a debate partner, aiding with coding, and even allowing conversations with historical figures. For students, this means having access to a tutor who never sleeps and providing constant support and encouragement. Additionally, Khanmigo incorporates safeguards to prevent giving direct answers, ensuring students learn through guidance rather than rote memorizing.

Kim and Bennekin (2016), as reported in Crompton & Burke (2023), conducted a study on Alex, an AI assistant used in a college mathematics course. Alex interacted with students by asking diagnostic questions and providing support tailored to student needs. This support was organised into four stages: goal initiation (“Want it”), goal formation (“Plan for it”), action control (“Do it”), and emotion control (“Finish it”). Alex offered help based on the specific needs of students in different subject areas, promoting perseverance in their academic pursuits and enhancing their academic results. This study highlighted the role of AI in ensuring timely support and adapting to students’ academic abilities, preferences, and optimal support strategies.

Therefore, these AI technologies enhance the accessibility, involvement, and efficiency of learning, enabling students to maintain their engagement and motivation (UNESCO, 2023a). The consistent presence of AI mentors ensures that students can access assistance whenever necessary, without having to wait for office hours or scheduled tutoring sessions. This instant support aids students in staying on course and promptly addressing any doubts.

3.2.2. Course assistance

GenAI tools for course assistance can also revolutionise the way students organise course materials and prepare for their classes. They can organize lecture notes, schedule study sessions, and provide reminders for assignments and exams (Sajja et al., 2023). Given that these tools analyse students' learning patterns, they can also offer tailored recommendations to optimise study habits. For example, platforms like Mindgrasp provide comprehensive GenAI-driven solutions that curate relevant study materials, highlight key concepts, and answer challenging questions in real time.

AI course assistants also facilitate communication and information retrieval, allowing students to ask questions related to the syllabus, such as exam dates, upcoming class materials, homework assignments, attendance, and grade and course expectations (Sajja et al., 2023). For instance, tools like Quizlet's Q-Chat and Course Hero's AI assistant offer interactive features that enable students to receive instant, accurate responses to their queries, enhancing their preparedness and engagement with the course content.

3.2.3. Homework and exam preparation

GenAI-driven course assistance tools are also valuable for homework and exam preparation (Labadze et al., 2023). These tools can generate summaries of lecture notes, making it easier for students to quickly review key concepts. This, allied to the fact that these tools can highlight parts of the lesson that students did not understand well and offer extra materials and explanations, can also help students grasp difficult topics better. Flashcard creation is another significant feature of GenAI tools. By converting lecture notes and textbooks into flashcards, these tools facilitate active recall, which is a proven technique for enhancing memory and learning efficiency (Roediger & Butler, 2011). Moreover, the interactive and personalised feedback offered by these tools can also be very useful for homework preparation, helping students improve their practice problems and/or assignments.

Regarding exam preparation, students can use GenAI tools to quiz themselves, reinforcing their knowledge (Choi et al., 2023). In addition, GenAI tools can predict potential exam questions based on the course content. This feature could help students focus their study efforts on the most relevant material. For instance, AI algorithms can analyse past exams and current course materials to generate exam questions, providing students with a targeted and efficient study guide.

3.2.4. Skills development

GenAI tools can aid in developing various skills essential for academic and professional success (Labadze et al, 2023). According to the authors, these are (i) enhanced writing skills, (ii) problem-solving abilities, (iii) group collaboration, and (iv) critical thinking and analytical skills.

In terms of (i), GenAI tools offer syntactic and grammatical corrections, stylistic suggestions, and vocabulary enhancements. This helps students produce clearer writing (Kaharuddin, 2021). For instance, tools like Grammarly provide real-time feedback on

grammar and style, allowing students to learn and improve their writing proficiency over time.

Regarding (ii), GenAI can enhance problem-solving abilities by providing detailed solutions to complex problems, which not only helps students arrive at the correct answer but also enhances their understanding of the underlying concepts and methodologies. Concerning (iii), the structured discussion frameworks provided by GenAI also support group discussions and debates, while simultaneously offering real-time feedback to participants. These tools can suggest discussion topics, outline structured arguments, and highlight key points, improving the quality and effectiveness of group interactions. GenAI-driven platforms can support debate preparation and execution, enabling students to engage in more meaningful and organised discussions.

GenAI tools can also contribute to developing critical thinking and analytical skills (Kasneci et al., 2023). By analysing large datasets and generating insights, AI can assist students in conducting thorough research and developing well-supported arguments. This exposure to advanced data analysis techniques prepares students for future academic and professional challenges, enhancing their overall intellectual capability.

3.3. Main Opportunities and Threats

3.3.1. Opportunities

3.3.1.1. Advanced study support: tutoring sessions, autonomous exercise creation, and mock oral examinations

As GenAI continues to evolve, its ability to provide precise and insightful feedback will improve. By analysing larger and more complex datasets, AI can detect subtle patterns in student performance, offering highly targeted recommendations for improvement. Areas that can significantly benefit from these advancements are (i) personalised tutoring sessions, (ii) autonomous creation of exercises, and (iii) mock oral examinations.

Regarding (i), currently, GenAI-powered tutoring systems already provide real-time, 24/7 support tailored to the student's profile. In the future, these systems could become even more adaptive, making interactions more seamless and intuitive. Additionally, enhanced emotional recognition could allow AI tutors to adjust their teaching strategies based not only on students' performance but also on their emotional states, providing more empathetic and effective support (Padron-Rivera et al., 2018).

Concerning (ii), it can be expected that, in the future, GenAI tools autonomously create even more personalised and varied exercises, integrating multimedia elements to meet different learning preferences. Advanced data analytics might also allow AI to predict learning trajectories and proactively adjust study plans to optimise long-term retention and understanding.

In terms of (iii), GenAI can simulate real exam scenarios, ask questions, evaluate responses, and offer feedback. Enhanced feedback mechanisms, including detailed analysis of verbal and non-verbal communication skills, could help students refine their presentation and public speaking abilities. Furthermore, augmented or virtual reality tools can allow to creation of immersive, lifelike exam environments, offering an even more comprehensive preparation experience. These technologies could be especially useful for preparing presentations and thesis defences.

3.3.1.2. Enhanced self-learning management

GenAI holds substantial promise for the future of learning management by transforming how students themselves can evaluate, assess, and regulate their learning processes (Kasneci et al., 2023; Liang et al., 2023). Looking ahead, GenAI will provide tools that enable students to gain deeper insights into their learning behaviours and progress, which can foster greater autonomy and effectiveness in their educational progress.

Specifically, the advancement of GenAI settings will allow the provision of precise and insightful feedback, helping students to identify their strengths and weaknesses with higher accuracy. This will empower them to take active steps in their learning path, adjusting their strategies and efforts to achieve better outcomes. Moreover, students will be able to identify their knowledge and readiness more accurately for exams or assignments, allowing them to be better prepared and to develop deeper knowledge and competencies.

Moreover, AI will be able to predict potential learning challenges and suggest interventions before issues become significant (UNESCO, 2023a). For example, AI could alert a student at risk of falling behind or recommend alternative study methods to enhance comprehension and retention. This proactive support ensures students receive timely, targeted help, leading to more successful learning outcomes.

3.3.1.3. Enhancing research skills

According to Al-Zahrani (2023), GenAI enables researchers to automate certain tasks, augment their capabilities, and explore new possibilities in data analysis, knowledge discovery, and problem-solving, enhancing research productivity, enabling discoveries, and accelerating scientific progress in various fields. GenAI "can be a tool for the quick and easy generation of data samples for various types of research, based on patterns and structures", and that "[such tools] can also be used as an analysis tool", or "as a writing assistant for research reports."

A recent example is the fully automated experiment for double-blind online randomised controlled trials by Cingillioglu et al. (2024). This system autonomously manages participant interactions and group allocations. It demonstrated AI's efficiency in data collection, establishing causal relationships, and producing reliable results, highlighting its potential to improve the efficiency, rigour, and ethics of educational research.

In this sense, and as students become more familiar with these tools, expressing positive perceptions about their potential to revolutionise academic research and generate new insights (Al-Zahrani, 2023), they will be used for more purposes than those exposed earlier in this Section. For literature reviews a tool such as SciSpace, which applies GenAI to an enormous set of papers published in peer-reviewed journals, is of enormous advantage. This will allow both professional and young researchers, such as master's and PhD students, to efficiently select relevant literature and process large datasets, identify patterns, and draw comparisons that would be too time-consuming to perform manually. Consequently, students can focus more on interpreting results and deriving meaningful conclusions, enhancing their studies' depth and precision.

Furthermore, GenAI can automate the collection and synthesis of information from numerous sources for compilatory studies, enabling students to quickly compile comprehensive literature reviews and meta-analyses, identifying key findings and gaps in existing research, saving time, and improving the quality of their reviews (UNESCO, 2023). GenAI's predictive capabilities can guide students toward emerging research trends, helping them align their studies with future developments in their field (Al-Zahrani, 2023).

3.3.1.4. Boost to asynchronous education and student self-motivation

The above-mentioned features of GenAI allow for asynchronous learning, avoiding the one-size-fits-all trap and making learning more engaging and effective. These technologies present a significant opportunity in education: increasing students' self-motivation (Memarian & Doleck, 2023).

Student self-motivation can be further enhanced through gamified learning (Johnston et al., 2024). By integrating game elements into educational content, students can benefit from a more engaging and enjoyable learning process. For instance, a student studying math might complete levels and earn rewards as they master different concepts, while a history student could embark on virtual quests to explore ancient civilizations. These gamified elements can make learning more fun and interactive, enhancing student motivation and retention of information.

In this context, Memarian and Doleck (2023) stated that "such effects [in student self-motivation] need to be studied in the long term and efforts need to be made to study student motivation changes based on their learning and demographic backgrounds". From a distinct perspective, another opportunity that arises from the deployment of GenAI is its potential to bridge gaps for students worldwide, allowing the democratization of knowledge where every student has access, independently of their location or economic status.

3.3.2. Threats

3.3.2.1. Lack of critical thinking and creativity

In terms of critical thinking, there are conflicting effects of GenAI on students. As mentioned above, GenAI could promote critical thinking by exposing students to step-by-step explanations and exercises that challenge their understanding and encourage deeper analysis. However, tools (such as ChatGPT) "may also lead to the students' [over-]reliance on software and result in reduced self-assessment and critical thinking among students" (Memarian and Doleck, 2023).5

In fact, if students become too dependent on GenAI for answers, they will struggle to develop their own problem-solving and idea creating skills. The convenience of having an

[5] We conducted a test with ChatGPT. Initially, we asked in English for a syllabus for a public economics course, and it produced a well-designed syllabus based on existing and reputable bibliography. Subsequently, we asked the same question in Portuguese, specifying that we needed Portuguese bibliography. ChatGPT produced a similar syllabus in Portuguese, but all five references were invented. One of the authors of this report discovered that he had a "new" book attributed to him that he had never written.

AI system readily provide information and solve problems could lead to a passive learning attitude, where students might accept AI-generated solutions without questioning, especially under time pressure. This dependency can result in a decline in original thinking and the ability to generate unique ideas independently (Kurtz et al., 2024; Abbas et al., 2024).

3.3.2.2 Stimulus overload and dependence

We described above how ITSs can provide feedback on learning progress and nudge students towards better learning outcomes. If these are not implemented with moderation, students could become quickly overwhelmed by the amount of feedback they receive in multiple courses simultaneously, possibly even from different systems and with multiple deadlines to respond to. This can lead to negation, abandonment, and in the worst case permanently harm the self-confidence of students in their own abilities.

Students may also become dependent on the constant stimuli provided in gamified learning environments, neglecting other important activities not covered by the system6 and becoming incapable of being autonomous when left on their own. Students need to learn how to set their priorities and allocate their time accordingly, without tutoring systems telling them what to do and when to do it.

3.3.2.3. Increased individualism and reduced social skills

While GenAI creates opportunities for group discussions and debates, by offering structured discussion frameworks and real-time feedback (Labadze et al., 2023), it can also lead to social isolation. As GenAI systems provide tailored content and instant feedback, students might find themselves spending more time interacting with machines rather than engaging with peers and educators (Felix, 2020).

This shift could result in reduced opportunities for collaborative learning, which is the whole point of visiting an HEI and which is vital for developing empathy and communication and teamwork skills. The lack of social interaction can hinder students' ability to work effectively in group settings and diminish their overall social competence (Marrone et al., 2022).

[6] This is a classical topic discussed in the economics of incentive provision.

3.3.2.4. Hallucinations and reinforcement of biases

There are other potential dangers associated with GenAI in this area: GenAI systems can make errors ("hallucinations"), which are due to their nature as statistical prediction machines – they are not databases of "facts".

Furthermore, while AI can reduce bias in decision-making by minimizing human subjective interpretation of data—leading to more objective and data-driven outcomes—it can also magnify it (UNESCO, 2023a). The underlying cause is that biases present in the training data are passed down and perpetuated in the model structure. The lack of diversity among engineers and researchers developing GenAI products can exacerbate this issue. The gender gap in the science, technology, engineering, and math (STEM) fields, including AI research, significantly contributes to this problem. Moreover, GenAI can magnify societal issues extending beyond gender bias to include racial, social, and cultural discrimination, which increases its the societal impact and perpetuates unfairness.

Both hallucinations and biases are particularly problematic in the educational context, where students should rely on accurate information to learn and develop their understanding. This issue creates a critical need for students to be taught how to double-check and verify the information provided by GenAI systems. In Chapter 5, mechanisms and recommendations to address this issue will be provided.

4. Higher Education Institutions: Organizing and Planning

AI has arisen from an information society undergoing a transformation marked by the expansion of new technologies aimed at digitalisation, global real-time networking and production, and automation of productive processes (European Commission, 2018). As these technologies advance, they increasingly find applications beyond traditional industrial sectors. The development and implementation of tools that enhance time and task efficiency are becoming increasingly prominent in education systems, particularly within the higher education sector.

One driving force behind this trend is the goal of democratising higher education and accommodating the international student market, creating pressures due to the large number of enrolled students (Novoselova, 2023; Popenici & Kerr, 2017). These drive the need for efficient tools that help manage large student populations and improve educational outcomes. Moreover, as the usage of GenAI technologies spreads across the

various levels of education – teaching, learning and even research –, HEIs are obliged to rethink their role, governance, and management processes.

Hence, incorporating AI into higher education requires addressing technical and organisational aspects, such as hardware resources, software needs, data management approaches, staffing and expertise, as well as security and privacy issues (UNESCO, 2023a). The increasing development of AI is likely to affect many administrative roles within HEIs that typically require significant human and financial resources, such as IT services, admissions, student assistance, libraries, and marketing and accounting departments.

4.1. Findings from the Literature

The implementation of GenAI in higher education encompasses a broad spectrum of applications, including institutional and student administration. At the institutional administration level, before the breakthrough of GenAI, AI tools were already used in various capacities, particularly in data governance (Beerkens, 2021; UNESCO, 2023a). These tools collect, process, and analyse large volumes of data to facilitate decision-making processes, by providing valuable insights that support effective governance and strategic planning. Such insights are crucial for transparent and evidence-based decision-making (De Wit & Broucker, 2017).

More recently, GenAI applications have been developed to further improve institutional administration, by reducing the existing high volume of administrative tasks and liberating resources from low-value activities to core operations. For example, GenAI is being used to execute class scheduling and educator allocation. Additionally, public-facing tasks such as managing student inquiries and providing campus information are being streamlined through AI-powered chatbots and virtual assistants (Labadze et al., 2023; Popenici & Kerr, 2017).

From the student administration perspective, these technologies offer substantial value by enhancing efficiency and providing comprehensive support throughout students' academic path, from critical phases such as admissions and financial aid to continuous assistance in student services and proactive measures aimed at reducing dropout rates (UNESCO, 2023a). For admissions and financial aid, chatbots can be used to clarify students' questions and help them get the information they need in a much faster and personalised way. Furthermore, AI assistants are also being used to offer ongoing student support to various kinds of modalities: tutoring, organizational help, social and campus

life, and career guidance. Finally, sophisticated data analysis of academic records and performance generates early warning reports, identifying at-risk students and enabling timely interventions to prevent dropouts (Ge & Hu, 2020; Crompton & Burke, 2023; Nagy & Molontay, 2023).

Apart from these applications, GenAI tools in student administration can leverage additional data to enhance the student experience further. According to Ge and Hu (2020), universities can gather online consumption data, credit payment information, and campus card usage to improve administrative decisions. This data can be used to optimise dormitory assignments and roommate matching, enhancing communication and creating a positive learning and living environment. Evidently, care should be taken due to the highly personal natura of this data.

In exploring specific use cases of AI in higher education administration, notable applications include enhancing student recruitment strategies and implementing comprehensive support systems for both students and educators.

4.2. Use Cases

4.2.1. AI tools for planning and evaluating degree programs

Over the past few decades, HEIs have increasingly implemented performance management practices, with more data being collected and more sophisticated indicators being computed, recurring to big data techniques. Moreover, the amount and type of data collected has been increasing, and the purposes for which the data is used is constantly changing, reflecting the shift of priorities over the years (Beerkens, 2021). Specifically, performance indicators are used at three levels: to reflect on the performance of the system, on that of individual universities, and on that of sub-units within organisations.

In this sense, GenAI can play a significant role by enhancing the capacity to collect, analyse, and use data for performance management. GenAI tools can automate the data collection process, identify patterns and trends, and present the output in a form that is adequate for its users and their needs. For instance, GenAI can assist in planning and evaluating degree programs by predicting future trends in student enrolment and industry needs. Additionally, it can evaluate the effectiveness of current programs by analysing student performance data, graduation rates, and employment outcomes, so that institutions can adapt their programs accordingly.

Finally, GenAI can assist in drafting degree programs and designing courses, including setting learning goals and conducting consistency checks. It can also enhance the

complementarity between courses by analysing all existing syllabi and constructing new ones based on this information.

4.2.2. AI tools for student recruitment

The process of student recruitment includes many steps, two of the most important being (i) thoroughly answering students' queries regarding the degree programs and university, and the other (ii) advertisement, either through social media platforms or direct and personalised communication to prospective students.

In the case of (i), the most common GenAI tool to answer students' questions are chatbots (UNESCO, 2023a; Labadze et al., 2023), as they are designed to mimic human conversation using text to provide information in a conversational manner. In fact, according to Ilieva et al. (2023), "intelligent chatbots can execute a wide range of business functions, including sales and marketing, personal assistance, and information retrieval." This makes chatbots particularly attractive for universities aiming to enhance their recruitment processes, as they can provide instant responses to frequent questions, guide prospective students through application procedures, and even offer personalised program recommendations based on student interests.

For (ii), advertisement campaigns can be designed and optimised for specific student groups by using GenAI tools to create social media content and commercial scripts with higher click-through rates, as well as develop personalised communication (emails and messages). The data used for those communication purposes can be of various forms: demographic and geographic data, behavioural data (e.g., website visits, interaction with previous market content, as well as in social media platforms), previous communications (e.g., email inquiries and chat conversations), survey responses, and interactions from social media platforms.

This approach not only reduces marketing costs but also increases engagement. For example, Element451 uses AI to enhance student engagement through personalised communication, analysing data to identify prospective students and tailor recruitment messages. Additionally, other tools facilitate peer-to-peer engagement, allowing potential applicants to ask questions and gain insights into the student experience.

An innovative tool that potentially enhances recruitment processes is the E360 Tailor's University Virtual Campus Tour. By integrating GenAI, it analyses campus data, prioritises elements, selects relevant locations, and crafts tour content accordingly. This creates a

multi-stop campus tour tailored to the candidate's interests and needs, providing an engaging virtual experience for each prospective student.

With time, similar innovations are expected to transform student recruitment even further, offering increasingly personalised and immersive experiences tailored to the specific interests and needs of prospective students, and making the process more engaging and effective.

4.2.3. AI tools for student accompaniment

Even before the breakthrough in GenAI, universities were already evolving their processes to provide more instant and intuitive assistance to students. In 2016, IBM developed Jill Watson, an AI-powered virtual teaching assistant designed to support individual courses by answering student questions like a human teaching assistant, incorporating ChatGPT in 2022. Jill Watson answers basic student course questions and helps students with course content, such as explaining topics and assisting with assignments.

Nonetheless, as previously mentioned, student support extends beyond AI tutoring and course assistance, encompassing all aspects of student life. Universities are implementing AI-driven solutions to enhance various facets of the student experience (Pence, 2019), to ensure that students receive timely and personalised assistance, helping them navigate both academic and non-academic challenges effectively.

For instance, the University of Michigan developed two AI tools: a general AI assistant (U-M GPT) and a personalised AI tool (U-M Maizey). The first consists of a versatile assistant available to all campus members, capable of answering any academic or university-specific questions, summarizing general information, and producing written work. Users can choose between AI models like GPT-3.5, GPT-4, and Llama 2, and students can access it at no cost, generating up to 25 prompts per hour without using user-specific data for training to protect privacy. U-M Maizey, on the other hand, connects to personal accounts on Google and Canvas to provide customised answers and insights. It allows students to upload unstructured texts, adjust the AI tool's "temperature" for output sensitivity, and use or share their customised tools. While U-M Maizey was free through 2023, it required a monthly fee afterward.

It is expected that AI student assistant tools will move from chatbots to omnipresent tools that provide multimodal support, available anytime and on any kind of device. These

advanced tools may even incorporate voice functions to make student interaction easier and more intuitive.

4.2.4. AI tools for assisting educators

Generative AI can reduce educators' workloads by automating tasks such as lesson planning, grading, feedback provision, and routine administrative duties (OECD, 2023). This automation manages time-consuming activities, allowing educators to focus on personalised teaching, facilitating small group activities, and engage more meaningfully with students. As a result, educators can evolve into mentors and inspirational leaders within their educational settings (Chan & Tsi, 2023). Additionally, these time savings enable educators to engage in other significant activities, such as securing research grants and publishing in prestigious international journals (Felix, 2020).

Various technological solutions have already been developed to assist educators. For instance, researchers from the University of Surrey developed KEATH.AI, an AI system providing rapid and accurate essay assessments with an 80% baseline accuracy. It allows educators to modify scores, customise grading rubrics, and generate detailed analysis reports on student performance. Similarly, GRAIDE, created by PhD students at the University of Birmingham, enhances grading by learning an assessor's style. It accepts written and digital submissions, reducing grading times by 87% and offering seven times more feedback.

4.2.5. AI tools for the back office: profiling, prediction, and dropout reduction

The implementation of GenAI technologies in HEIs presents a prominent opportunity for profiling and prediction, facilitating the timely identification of students at risk of dropping out by flagging student learning status or performance before it is too late (Nagy & Molontay, 2023; Ouyang et al., 2022). Specifically, predictive GenAI tools can be used in various steps of the student lifecycle: prior to admission, and then throughout the learning process (Pierrès et al., 2024).

According to Pierrès et al. (2024), the initial stage involves predicting student performance before admission based on their CVs, while the subsequent stage focuses on identifying students at risk of dropping out from courses, study programs, or the institution, as well as determining their learning profiles. These types of analysis involve gathering information, such as knowledge levels (or knowledge gaps), skills and strengths

(Nagy & Molontay, 2023), learning styles or preferences, interests (Ouyang et al., 2022), grades, and class attendance.

This information can then be used to create metrics and real-time dashboards, as well as to provide feedback and guidance on content-related issues throughout the learning process, enhancing student retention and success (Zawacki-Richter et al.,2019).

4.3. Main Opportunities and Threats

4.3.1. Opportunities

4.3.1.1. Automation of administrative tasks

An opportunity for GenAI tools at the institutional administration level lies in optimising the creation of class schedules and allocating educators to class slots. These are among the most time-consuming and complex tasks within HEIs and still tend to be manual, involving many steps and relying on various forms of software and administrative coordination (UNESCO, 2023a).

Typically, departments submit course offerings, prerequisites, and educator availability, while information on classroom resources is gathered. Timetable planning involves manually inserting this data into spreadsheets or scheduling software, aligning course offerings with educator availability and resolving conflicts such as double-booked rooms and overlapping classes. These processes heavily rely on tools like Microsoft Excel and specialised software, requiring substantial manual oversight.

Currently, HEIs can already benefit from AI platforms that analyse data sets (including educator availability, course requirements, student enrolments, and classroom resources) to minimise conflicts and optimise resource use. They dynamically adjust to real-time changes, providing flexibility and responsiveness that traditional methods lack.

Still, GenAI can further enhance these benefits, as future advancements in such tools could focus on developing more intuitive and integrated platforms that seamlessly combine various administrative functions. Additional enhancements could include advanced predictive analytics to anticipate scheduling conflicts before they arise and machine learning algorithms that continually improve scheduling efficiency based on historical data. Moreover, incorporating user-friendly interfaces and real-time collaboration tools can facilitate better communication and coordination among

departments, reducing the manual workload and enhancing overall institutional productivity.

4.3.1.2. Breaking the walls of culture and disability in HEI

Another significant opportunity arising from the deployment of GenAI is the potential to break down remaining cultural, ethnic and disability barriers, which would foster a more inclusive and accessible learning and living environment. According to Pence (2019), AI agents will soon start to participate in collaboration and team building, resulting in more ethnically and culturally diverse teams.

Moreover, as discussed in Section 3, GenAI can offer real-time translation and culturally adaptive learning materials, facilitating communication and understanding among students from diverse backgrounds. Also, it can create culturally responsive and inclusive content that promotes representation, diversity, and fosters a sense of belonging (OECD, 2023)

On the disabilities front, Pierrès et al. (2024) mention that HE should be flexible and tailored to the diverse needs of students. AI may help provide the necessary personalization and adaptability, enabling individuals with disabilities to pursue higher education. If students with disabilities are considered not just in the development and adoption of AI educational technologies, but also included in the discussions for the conception and implementation of these tools, they may benefit from an adapted pace of learning and flexible course schedules (García-González et al., 2020). Furthermore, AI-driven accessibility tools can provide support to students with disabilities by guaranteeing equitable access to educational materials (OECD, 2023).

4.3.2. Threats

4.3.2.1. Plagiarism and intellectual property rights

In Section 2, we discussed the threats of plagiarism from the perspective of educators. However, it is equally important to address this issue from the standpoint of higher education institutions, because plagiarism is a problem for the whole academic community. To understand why GenAI poses additional problems, first in defining plagiarism and then in detecting it, let us quote Harvard University's “Code of Honor” as a representative example:

"Members of the Harvard College community commit themselves to producing academic work of integrity – that is, work that adheres to the scholarly and intellectual standards of accurate attribution of sources, appropriate collection and use of data, and transparent acknowledgement of the contribution of others to their ideas, discoveries, interpretations, and conclusions. Cheating on exams or problem sets, plagiarizing or misrepresenting the ideas or language of someone else as one's own, falsifying data, or any other instance of academic dishonesty violates the standards of our community, as well as the standards of the wider world of learning and affairs."7

This Code of Honor fits well with pre-GenAI academia, where intellectual property rights were clearly defined, but seems out of step with the post-GenAI environment. Sources cannot be attributed accurately if these property rights are not properly defined. However, there are no property rights over the output of large language models or image generators – neither the owners of the training data nor the GenAI user. The term "plagiarism" is no longer adequate to capture the use of the outputs of these GenAI applications.8 But it is still relevant that, for the sake of academic integrity, "there should be an acknowledgement of the contribution of others" even though the "others" may be, in certain cases, GenAI applications.

The increasing use of LLMs and other GenAI tools in subjects that rely heavily on written outputs, such as essays, presents unique challenges. HEIs are currently in an experimental phase, exploring various strategies to effectively manage and integrate these tools into their academic processes. According to UNESCO (2023a), some of the strategies so far implemented consist of (i) banning ChatGPT in assessments or entirely; (ii) using software to detect AI-generated text; (iii) shifting to oral, handwritten, or invigilated exams; (iv) employing assessments that AI struggles to produce, such as podcasts, lab activities, and group work; (v) establishing policies and guidelines for the ethical and transparent use of AI in teaching, learning, and research (for example, allowing a considered use of ChatGPT); and (vi) creating new assessment forms using ChatGPT explicitly.

However, these measures do not seem to be sufficient, nor widely implemented. For instance, regarding (v), some universities have set explicit guidelines for AI use in classrooms (e.g., University of Southern California, Nova School of Business and

[7] From https://oaisc.fas.harvard.edu/honor-code/ accessed in August 2024.
[8] In the absence of a better word, we continue using it, meaning that the agent (teacher, researcher, or student) copies an output generated by AI, without making any significant changes and without mentioning that it was produced by a given application in a specific part of the text. The difficulty in defining "plagiarism" in this context shows why the concept is no longer appropriate.

Economics) and others have defined expectations about AI usage at both syllabus and individual levels (e.g., Ohio State University), but in a general manner students and educators still ask for more clarity on the rules. Malmström et al. (2023) found that although Swedish students are familiar with and have positive perceptions of using AI tools like ChatGPT and other AI language tools in education, most were unaware of any institutional guidelines for responsible AI use.

The issue becomes increasingly problematic as AI evolves rapidly, potentially outsmarting current educational practices and making tools such as software to detect AI-generated text less effective. According to Memarian and Doleck (2023), technologies such as LLMs introduce new forms of plagiarism, which require more advanced detection methods, creating a vicious circle of needing ever-greater computational power and advanced hardware to combat academic misconduct. This indicates that relying solely on detection software is not a sustainable solution to safeguard academic integrity. Implementing effective policies to address this issue is essential and will be discussed in detail in Sections 5 and 6.

4.3.2.2. The reinforcement of biases and inequality

The potential of GenAI to transmit human biases can be controversial. As previously mentioned, GenAI can play a crucial role in establishing a learning environment within HEIs that is more inclusive and accessible. It has the potential to bridge gaps, accommodate diverse learning needs, and foster a supportive atmosphere. However, GenAI can also perpetuate existing human biases, potentially exacerbating inequalities within HEIs and society at large. If not carefully managed, these tools could reinforce stereotypes and unfair practices, leading to greater disparity.

Biases can be present in the various steps of students' recruitment: targeting, admissions, and scholarship decisions. For instance, according to UNESCO (2023a), AI can tailor fees to financial capacity, but the databases powering AI often contain biases from historical, algorithmic, sampling, and human sources. This can lead to biased admissions, negatively impacting students' futures (Berendt et al., 2020). Additionally, evidence suggests that these algorithms tend to reduce scholarship funding (Jaschik, 2021) and do not account for unexpected costs, affecting students' ability to stay in school. Consequently, AI using data from a majority group can inadvertently exclude minority groups, perpetuating exclusion and lack of diversity.

Moreover, inequalities may also be present at the learning level. The content created by GenAI tools may not follow established pedagogical methods. Take, for instance, the case of students with impairments: European Commission (2022) questions whether GenAI systems provide appropriate interaction modes for learners with disabilities or special education needs. This includes addressing whether the AI system is duly designed to treat learners respectfully and adapts to their individual needs.

Both educators and HEIs have a role in this matter, by assuring human agency and oversight, when implementing GenAI. Particularly, HEIs must implement monitoring systems to follow up on and eliminate these types of occurrences.

4.3.2.3. Data leaks and privacy violations

A fundamental requirement for GenAI functionality is a substantial amount of data, which underscores the critical importance of data security and privacy, especially as the volume of data increases exponentially, making it a prime target for cyber threats (Kurtz et al., 2024), such as ransomware. Chatbots with access to private information, such as those meant to assist students, can often be provoked into leaking this information even though they were designed not to do so.

These vulnerabilities pose significant challenges in academic settings (George, 2023), especially since IT personnel may not be trained to deal with cyber threats on these systems, or not enough personnel may be available.

4.3.2.4. Environmental and economic sustainability

Analysing the implementation of GenAI in HEIs raises sustainability concerns from two angles: the environmental and the economic standpoints. Regarding the environmental perspective, it is expected that academic and research use of AI will drive energy consumption levels. In fact, according to Ray (2023), “the large size and complexity of ChatGPT models require significant computing resources, which can have negative environmental impacts. Improving the energy efficiency of ChatGPT models is an important challenge that needs to be addressed.” In this sense, as AI and machine learning models become more sophisticated, the demand for computational power and energy increases, leading to higher carbon footprints.

From an economic perspective, HEIs will have to invest heavily in AI technologies to attract students, faculty, and funding, leading to a rapid escalation in spending on AI

research and infrastructure. However, developing, implementing, and maintaining advanced AI systems is expensive. As stated above, significant financial resources are required for computational power, data storage, skilled personnel, and ongoing research and development. The direct consequence is that such high costs could strain the budgets of HEIs, especially those with limited financial resources (UNESCO, 2023a). Additionally, given the high costs associated with AI technologies, only major, well-funded organizations will have the financial means to participate in the AI competition to start with. This could lead to the concentration of AI knowledge and resources within a small number of institutions, widening the gap between these and smaller or less prosperous universities. Consequently, this may lead to an even more tilted playing field in higher education, with leading institutions drawing an ever-higher number of students, research opportunities, and financial backing.

5. How to Minimise Risks While Tapping the Potential of GenAI

This chapter discusses how the risks of GenAI in higher education can be managed while harnessing its potential. The preceding chapters highlighted the risks associated with implementing GenAI for educators, students, and higher education institutions. Here, we propose measures and programs to address and mitigate each of these identified risks, ensuring a safer and more effective integration of GenAI in educational environments.

5.1. Educators

As GenAI technologies become part of HE systems, educators are not just expected to adapt to these technologies, but crucially must be empowered to do so. This empowerment should allow them to focus more on guiding new learning approaches and detect monitoring biases, ensuring that learning methods are effective and free from unfair biases that might affect students' outcomes. With this shift, educators' priorities will change, with more time spent planning how to teach effectively rather than creating the actual teaching materials (Celik et al., 2022). The burden of administrative tasks will also be reduced – allowing educators to concentrate on the more critical aspects of teaching –, and the evaluation methods will evolve towards more practical approaches, instead of relying mostly on traditional written assignments (Abbas et al., 2024).

However, these opportunities come along with other kinds of issues. It is thus crucial that educators are prepared to confront and surmount them.

5.1.1. Risks "Shift in students' trust: Educators vs. GenAI" and "Job Displacement: the potential of GenAI to automate teaching positions"

To prevent the weakening of the role of educators caused by continuously implementing GenAI tools, investment must be made in their professional development (UNESCO, 2023a; Lee et al., 2024). This includes training sessions provided by HEIs covering tool functionalities, how and when to use those functionalities, their advantages and disadvantages, student guidance, and the policy guides for their usage.

Additionally, educators must retain student engagement. In this sense, finding ways to help educators boost student engagement levels beyond what GenAI tools can achieve is crucial (U.S. Department of Education, 2023). This means providing educators with the freedom to bring themselves and their personal experience to the lecture room even in the presence of AI support. It can also mean providing educators with tools that allow them to better track their teaching performance by delivering metrics on student engagement and behaviours during class (U.S. Department of Education, 2023). This information will then help educators adapt their teaching methods.

Safeguarding the unique and irreplaceable value of human educators is crucial. To achieve this, rote lecturing can be replaced by interactive teaching methods such as collaborative learning and whole-class discussions (OECD, 2023). In addition, it is important for educators to make use of their positions to provide individualised support to students. This may involve guidance beyond the strict context of classes, giving recommendations regarding career paths and academic pursuits, guiding students around their personal obstacles, and assisting them in establishing and attaining their personal objectives. By concentrating on the overall growth of students, educators can tackle emotional, social, and ethical aspects of learning that AI tools cannot understand.

Finally, it is crucial that educators participate in developing and implementing these tools in the context of their institution. This cooperation will help design user-friendly tools, making it easier for educators to engage with and comprehend these systems. Moreover, educators should have channels to provide ongoing feedback on the performance and transparency of AI systems. This feedback should be used to improve and adapt AI tools continuously.

To prevent a decline in the number of graduate students financing their advanced degrees through TA roles, HEIs need to reconsider the role of TAs in GenAI-based teaching, to determine how their role can evolve alongside with technology. This involves identifying which new essential tasks have arisen. It is possible that TA roles will require more human interaction, such as mentoring students and facilitating group discussions. TAs might also help educators conduct in-depth analyses of students' performances and behaviours. However, if TA roles diminish, it is crucial to establish alternative financial support methods for graduate students, such as research grants and fully funded PhD fellowships.

5.1.2. Risk "Insufficient technological ability to detect plagiarism"

In Section 2.3.2.2. we pointed out that AI detection tools are ineffective in identifying plagiarism due to their lack of accuracy. There are various approaches to address this issue. First, it is crucial for educators to modify their assessment techniques (UNESCO, 2023a) in a way that fosters personalization and interaction, such as oral exams, presentations, and in-class writing tasks; and which enables continuous evaluation, allowing the evaluation of students' ongoing progress through projects, portfolios, and regular quizzes (OECD, 2023). Educators can also promote original work (by designing assignments that require original thought, critical analysis, and personal reflection), and employ project-based learning as well as problem-solving tasks that require original solutions and creative thinking (OECD, 2023).

In addition, it is crucial to offer educators training to assist them in identifying and dealing effectively with AI plagiarism, and that instruct them in developing assessments that reduce the likelihood of plagiarism (European Commission, 2024). For instance, Cotton and Cotton (2023) provide suggestions to help detect plagiarism, mentioning strategies such as identifying patterns or irregularities in the language, checking for sources and citations, checking for originality, and checking grammar and spelling.

Finally, educators can contribute to promoting ethical AI use by incorporating conversations about the fragilities of AI models and their ethical use into their lectures. This can help students comprehend the potential consequences of AI-generated plagiarism and the negative effects on their own learning resulting from their excessive employment. They can also encourage students to use AI tools responsibly and openly, such as employing them as aids in idea generation instead of replacements for creating original work.

5.1.3. Risk “Ethical challenges in automating student evaluations"

The ethical implications of automatic categorisation of individuals and the impact of such categorization on the individual's well-being, status, or dignity, have been the subject of scrutiny in recent times. Article 22(1) of the GDPR states that any “data subject shall have the right not to be subject to a decision based solely on automated processing,9 (…) which produces legal effects concerning him or her (…)”. More recently, the EU Artificial Intelligence Act (AI Act) of 2024 has added human oversight as a measure to combat AI violations of fundamental rights (Article 14) and has established transparency requirements by requiring AI systems to disclose that AI generates their output.10

Educators using AI in their grading tasks will still have to oversee and participate in the assessment of each student. They should also be transparent about whether they are using AI in their grading, which is fair since that same transparency is required from students. However, there may be reasonable exceptions, such as in the case of short-answer questions. Similar to traditional multiple-choice questions, a quick assessment of answers may be amenable for AI grading without posing significant ethical concerns. This will not be the case for other types of assignments, specifically those that are designed for longer open answers.

Still, an extra challenge needs to be addressed in the context of evaluations under more personalized teaching. If GenAI allows educators to adapt their educational approaches to different students, should different educational methods be combined with a common grading scale? In other words, the trade-off between rewarding the absolute level of skills (“what does the student know?”) and learning progress (“how much have they learned?”) may have to change. In this scenario, it may become necessary for educators to prioritise evaluating fundamental skills, while guaranteeing fairness and consistency in assessments. Combining formative assessments and performance-based assessments (such as projects and presentations) can also be beneficial, as the former are tailored to individual learning paths and contribute to a comprehensive understanding of student progress, while the latter allows students to apply their knowledge and skills in authentic contexts, providing a more accurate measure of their abilities. The overall learning achievement of the individual may be more important for school or undergrad environments, as it demonstrates long-term progress and proficiency, whereas the level of knowledge and ability is more relevant for the final years of university, where the

[9] https://eur-lex.europa.eu/eli/reg/2016/679/oj
[10] https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai

emphasis is frequently on the immediate use of knowledge and skills. Regardless, it is important to communicate the evaluation criteria, methods, and expectations clearly and transparently to students so that they understand how they will be evaluated.

5.1.4. Risk "Lack of transparency or explainability in AI systems"

Educators should also receive AI literacy training to better lead with the lack of transparency and explainability of most AI models (Lee et al., 2024; UNESCO, 2023a), covering areas such as the operation of AI models, common sources of bias, and methods for interpreting AI outputs. These training sessions should also equip educators with the skills to identify and report biases, ensuring they can effectively intervene when biases are detected during the course.

Moreover, and to address this issue effectively, it is crucial to implement transparent AI systems specifically designed for clarity and explainability (UNESCO, 2023a). This entails selecting AI solutions that provide clear visibility into the decision-making process and the production of outcomes. In addition, it is necessary to establish and uphold policies that advocate for ethical and responsible AI utilization in education – which must define expectations for transparency, accountability, and educator participation in AI supervision, and comply with international standards and guidelines for ethical AI usage, to ensure alignment with best practices (UNESCO, 2023a).

5.2. Students

Incorporating GenAI technologies into higher education will lead to various shifts in students' roles and expectations. Assessments will need to focus more on students' application of knowledge rather than just memorization, with a higher priority on critical thinking, problem-solving, and analytical skills (OECD, 2023). Additionally, students will have to develop strong abilities in organizing and evaluating information, including collecting, arranging, and carefully assessing its significance, accuracy, and dependability.

5.2.1. Risk "Lack of critical thinking and creativity"

The training of students in using GenAI is as important as training educators. Educating students to develop of AI competencies, including GenAI-related skills, should encompass both human and technological aspects of AI (UNESCO, 2023). Specifically, it is crucial to integrate AI literacy into the curriculum to ensure that all students,

irrespective of their field of study, acquire a foundational understanding of AI. This approach will prepare students for the diverse impacts of AI in various professions and industries (Pence, 2019), and it should be accompanied by providing fundamental knowledge about the functioning of AI systems, including GenAI (Farrelly & Baker, 2023). Understanding the essential principles of machine learning, data management, and algorithm-based decision-making is crucial for understanding the capabilities and constraints of these technologies.

In addition, it is important to emphasise the ethical implications and biases in AI systems (Farrelly & Baker, 2023). Students need to understand how data biases can influence AI outcomes and the implications this has for fairness and equality. This understanding will enable them to critically evaluate the information generated by AI tools and recognise the importance of using these tools thoughtfully.

Finally, to prevent students from becoming dependent on GenAI tools, these tools must not offer immediate answers to students. Instead, these applications should offer hints or different actions that students can take to solve exercises or find information, allowing students to make the final decision. Furthermore, providing step-by-step feedback should allow students to comprehend their mistakes and improve, instead of instantly pinpointing what they are missing. This approach will help students understand how to enhance their learning.

5.2.2 Risk "Stimulus overload and dependence"

Gamified environments, where students constantly receive notifications and nudges, seem like a great idea to keep students involved with the topic they are studying. But if they are subject to too many of those stimuli they may simply desist and give up, or become insensitive, or become convinced that they personally are not good enough to keep up.

Therefore, gamified environments should be used with caution. Within each course, the number of nudges should be limited. Moreover, there needs to be coordination between the different courses in degree programs to avoid a tug-of-war between courses that leaves students exasperated (Similar coordination is already common with respect to out-of-class activities such as homework and group projects).

The second issue with gamification is that students may become dependent on nudges to decide on how to allocate their time, crowding out their own initiative and ability to take decisions by themselves. The first step to avoid this issue is again to refrain from

exaggerating the number and frequency of nudges. HEIs should also make sure that their students learn time-management skills and become autonomous in organizing their workload.

5.2.3. Risk "Increased individualism and reduced social skills"

To tackle this problem, it is crucial to foster collaborative learning environments (OECD, 2023) by designing courses that emphasise teamwork and group projects. The promotion of interaction and teamwork among students can be achieved through collaborative assignments that promote communication and collaboration among students, aiding in developing their social skills.

Other initiatives may include whole-class discussions, focusing on exchanging and comparing viewpoints, probing and expanding responses, and engaging in evidence-based arguments and discussions (OECD, 2023). In addition, it is important to facilitate face-to-face or synchronous virtual interactions, such as live discussions, debates, and Q&A sessions, to uphold a sense of community and ensure that students have many opportunities for social interactions.

5.2.4. Risk "Hallucinations and reinforcement of biases"

Uncritical use of GenAI output leads to the promotion of inherent biases and information made up by the GenAI system (hallucinations). It is important to educate students about facing either of those. This includes providing them with knowledge about how biases arise and the ability to critically analyse AI-generated content (Farrelly & Baker, 2023). For instance, this can be achieved by including AI ethics, data science, and critical thinking courses in the curriculum. Students must also learn how to assess and verify AI-generated results. Additional measures to avoid and combat biases are provided in Section 5.3.2.

5.3. Higher Education Institutions

The increased development and deployment of GenAI technologies in higher education will require HEIs to continuously monitor AI advancements and stay informed about their impacts and applications in education. This involves keeping track of enhancements in AI algorithms, software, and hardware and their incorporation into educational resources to

ensure the efficient utilization of advanced AI technologies and to detect potential risks and constraints (UNESCO, 2023a).

Additionally, HEIs need to work together to synchronise the implementation of GenAI technologies. Through collaboration, they can create consistent policies, exchange successful methods, and align their approaches, which will contribute to the development of common ethical standards, promote fair AI usage, and tackle issues such as bias, data privacy, and security. Equally important is to guarantee that AI policies are uniformly implemented by conducting regular audits and evaluations to uncover biases and ethical concerns, which, in turn, allows for the timely resolution of these issues (U.S. Department of Education, 2023).

5.3.1. Risk "Plagiarism and intellectual property rights"

Plagiarism needs to be addressed by higher education institutions from a more comprehensive standpoint, looking beyond the perspectives of students and educators. Addressing the challenges associated with plagiarism effectively requires a comprehensive intervention acting on multiple fronts. Specifically, HEIs need to establish comprehensive guidelines that delineate the ethical and conscientious usage of AI tools in education, academic pursuits, and scholarly investigations (UNESCO, 2023a). These directives should elucidate the conditions under which GenAI may be used and how this should be disclosed and supervised. Moreover, it is crucial to ensure accessibility, which means ensuring that faculty and students can easily reach these guidelines via the university's website, course outlines, and orientation materials (Cotton & Cotton, 2023). In this context, it is equally important to evaluate the efficiency of the adopted policies and strategies by gathering input from both faculty and students, as well as reviewing data related to plagiarism incidents (European Commission, 2024). This will allow for necessary adjustments to the policies to tackle any new challenges that may arise.

5.3.2. Risk "The reinforcement of biases and inequality"

To diminish the risk of accentuating biases and inequality in the context of student recruitment, HEIs need to (i) establish strong monitoring mechanisms to monitor and analyse the results of AI-based recruitment procedures (George, 2023), (ii) evaluate whether AI systems impartially assess applications from students with disabilities and offer the necessary assistance during the recruitment process, (iii) make use of AI to acquire data-driven insights into the efficiency of recruitment approaches and pinpoint

areas where algorithmic discrimination may arise; (iv) leverage AI to proactively identify students who may require additional support, such as tutoring, mentoring, or financial aid; and (v) incorporate the perspectives of students with disabilities to address ethical concerns and promote greater accessibility and inclusivity (Pierrès et al., 2024). This information can be used by HEIs to create scholarship programs that cover tuition fees and other associated costs to prevent dropouts. The qualification requirements for these scholarships should encompass a variety of skills beyond traditional academic evaluations.

In terms of student learning, it is essential to ensure that all students have equal access to AI tools (UNESCO, 2023a), as well as that they are provided with all the required support and resources, regardless of their socioeconomic and demographic backgrounds. Also, HEIs must ensure that GenAI educational tools are tailored to recognise and tackle the difficulties encountered by underrepresented groups (Pierrès et al., 2024), allowing equitable learning among all students. Moreover, to prevent biases in student evaluation, it is important to implement measures comparable to those recommended for addressing biases in student admissions.

To start with, it is essential to implement bias-reducing initiatives during the development of GenAI tools. Such initiatives should focus on promoting diversity (including gender, ethnicity, and geography) among the engineers, researchers, and designers involved in building AI systems (UNESCO, 2023a) and using inclusive and diverse training data. By doing so, a wide range of perspectives representing diverse demographics and viewpoints can be incorporated into the development process, reducing bias (UNESCO, 2023a).

5.3.3. Risk "Data leaks and privacy violations"

It is essential that HEIs develop AI systems that are designed to protect student data (George, 2023; Kurtz et al., 2024). However, this should be accompanied by other types of measures. For instance, HEIs should implement robust encryption methods, conduct regular security audits, and train staff and students on data privacy practices. Ensuring transparency in data collection and usage policies is also crucial, including compliance with data protection regulations to maintain students' trust.

Furthermore, it is important to establish standards and frameworks for the ethical use of GenAI, ensuring compliance with evolving regulations and ethical considerations while

maintaining transparency and accountability in data handling practices (Malmström et al., 2023; Johnston et al., 2024; Lim et al., 2023).

5.3.4. Risk "Environmental and economic sustainability"

As mentioned in Section 4.3.2.4, the sustainability issues associated with GenAI take two forms: environmental and economic. Regarding the former, universities should explore more sustainable practices, such as opting for systems that save energy and tapping into renewable energy sources to run their data centres (UNESCO, 2023a). Also, HEIs should participate in developing sustainable, energy-efficient hardware and software solutions, promoting recycling and responsible disposal of electronic waste, and considering the life cycle of products to address the environmental impact of computer science (Ray, 2023). Moreover, regulatory pressures and the push for greener technologies are expected to drive HEIs to innovate and adopt energy-efficient AI solutions. In this sense, establishing agreements on caps of energy consumption could help ensure fair competition between HEIs.

In terms of economic sustainability given the financial restrictions that most public HEIs are facing, one possibility is to encourage the establishment of consortia or partnerships to share financial resources and make advanced AI systems more accessible while also promoting collaborations between HEIs and industry partners to finance AI research and development efforts jointly (UNESCO, 2023a). Additionally, HEIs will need to advocate for increased government funding and grants specifically targeted for AI research and infrastructure in HEIs. Lastly, lending support to open-source AI projects that offer free and accessible tools for educational institutions can help reduce barriers to entry for institutions with limited budgets.

6. Conclusions and Recommendations

GenAI possesses significant potential to enhance the experiences of both educators and students within the realm of higher education and improve the functioning of higher education institutions (HEIs), attributable to its ability to deliver personalised learning experiences, optimise administrative processes, augment accessibility, and facilitate innovative pedagogical strategies. It can customise educational materials to cater to the unique requirements of individual students; assist educators in accommodating different learning styles and paces; automate routine responsibilities such as assessment grading;

improve accessibility by offering adaptive learning resources; and empower educators to explore novel and creative pedagogical methodologies.

At the institutional level, GenAI can transform various operational and academic procedures, increasing efficiency and efficacy. It can refine the allocation of resources through the analysis of patterns and the forecasting of requirements; can facilitate recruitment and the admissions process by catering communication to different groups of potential candidates and by automating the assessment of applications; can enhance student support via AI-driven chatbots and virtual advisors; can manage, analyse, and present substantial volumes of data, allowing for data-driven decision-making that enhances internal processes.

However, GenAI poses risks to all these three actors mentioned (educators, students, and HEIs) that must be carefully considered and managed. Such risks include biases in AI algorithms; privacy and data security; lack of transparency or explainability; ethical and plagiarism issues; sustainability issues; reduced critical thinking, creativity, and social skills in students; and workforce replacement.

It is possible to prevent and minimise these risks – if HEIs are aware of their existence and willing to confront them. Higher education institutions should take a proactive and comprehensive approach by:

Approving guidelines for the use of GenAI within each institution. More than general regulations at the university level, these should be adapted to the respective area of knowledge, since each faces its own specific issues (e.g., engineering, literature studies, data analytics, economics, or sociology).

Monitoring and updating AI systems so that they remain fair, transparent, effective, safe, and secure. This implies investing in both technology and IT workforce.

Prioritizing data security and privacy in the design of AI systems, by implementing rigorous measures to protect sensitive information.

Fostering a culture of ethical awareness among educators and students, ensuring that the use of GenAI aligns with the core values of education in general and in each academic community.

Involving various stakeholders (educators, students, technologists, and ethicists) in the development and implementation of AI tools.

Increasing digital and AI literacy of students, particularly of those applications that are more useful to their academic success, in order both to improve learning and to eliminate the effect of socio-economic factors on pre-university access to digital technologies.

Investing in regular training and professional development for educators and staff to equip them with the skills and knowledge needed to effectively integrate AI into teaching and administrative tasks while maintaining the human-centered aspects of education.

Of course, HEIs do not exist in a vacuum – students will have gone through at least a decade of schooling before they reach university. Educational policies at the high school level should already include an exposure to GenAI and discussions about its capabilities, strengths and weaknesses, and ethical issues. The coming generations of students will have experience with GenAI independently of whether school helps them use it responsibly or not.

Educators and students of HEI should proactively adapt to the increasing use of GenAI in teaching, learning and assessments:

Students will use GenAI extensively, and this is beneficial if it is done with transparency and respecting academic integrity and honesty. Educators should assist them and promote open conversations about risks and rules of AI usage.

Educators should focus their teaching on promoting critical thinking (in general and concerning the outputs of GenAI), make it interactive, and teach students how to learn.

At the same time, educators should be aware that students should not be subjected to too many messages and nudges from AI-driven tutoring systems, especially those that involve a gamified environment, to avoid cognitive overload, a drop in self-esteem if they cannot follow up, and a growing dependence on external stimuli to drive their choices.

Students should learn how to use GenAI tools productively and correctly, to improve their learning and prepare themselves for future careers in the labour market or in academic research.

Educators should give more weight to student evaluations that reward independent and critical thinking, problem solving, the ability to work in groups and present their work in public, at the expense of traditional evaluation methods based on reproducing facts or composing essays.

If the number of students is small, which tends to be the case at the master's level, educators should organize group presentations; while if the number of students is high, such as at the bachelor level, more written in-class examinations are warranted. Either of

these implies that educators will have to spend more time evaluating students, though group presentations can be an important part of a course designed to be interactive.

When educators use AI tools to perform the assessment of students' work, this should be transparent (indicated on the syllabus), and students should receive feedback, including the possibility to contest the grade.

Any implementation of an AI evaluation system should involve a pilot implementation that runs parallel to existing evaluation schemes, to determine whether the AI system's assessments are consistent and unbiased.

More research is needed to comprehensively discern the long-term effects of artificial intelligence in higher education at all the above-mentioned levels. Over the next few years, as new AI systems are being rolled out, and as policies are designed and implemented, significant experience will accumulate, which will require rethinking the mission of higher education institutions and the roles of educators and students.

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REPORT 11

Generative AI and Higher Education: Challenges and Opportunities

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ISSN: 2183-9360

September 2024

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