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AI in Higher Education

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**WP2 INFINITE AI
LITERACY TOOLKIT
TRANSNATIONAL REPORT**

UNIVERSITY OF NICOSIA

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Executive Summary

The transnational report is a summary and a comparative analysis of the research conducted to develop the first output of the INFINITE - artificial intelligence For professional aNd pedagogical practices in Higher Education project, which is co-funded by the Erasmus+ Programme of the European Union.

The research was conducted by six organisations in five countries (Cyprus, the Netherlands, Greece, Ireland, Belgium). The current state of Artificial Intelligence (AI) tools in Higher Education (HE) was explored in all five countries, where 259 university students, educators, staff, academics and researchers responded to a needs analysis online survey.

The desk research revealed that AI-based tools have a wide range of application potential in HE across professional and pedagogical practices to empower both educators and students. AI's impact is evident in its ability to streamline administrative tasks, empower data-driven decision-making, and personalise learning experiences. AI tools facilitate assessment and feedback, fostering student engagement with educational materials and virtual support systems. These applications hold immense potential to enhance teaching quality, administrative efficiency, and ultimately, the learning experience for all stakeholders.

However, as the needs analysis survey's results have shown and agreed upon in the desk research, the integration of AI in education also poses ethical, legal, technological, implementation and educational challenges, which necessitate clear guidelines, training and a focus on responsible use. The study also highlights concerns about the reliability and effectiveness of AI tools themselves, emphasising the importance of critical evaluation by educators and students.

Moving forward, a multi-pronged approach is crucial to foster a responsible and sustainable framework for AI integration in HE. This includes prioritising AI literacy training for both educators and students to equip them with the skills to navigate these complexities. Investment in robust technological infrastructure and fostering collaborative partnerships between educators, and technologists are also essential. Exploring emerging AI technologies and interdisciplinary approaches holds the key to unlocking their full transformative potential in HE.

Limitations exist, such as possible contextual specificity and survey response biases. However, this research provides a valuable foundation for further exploration of AI's role in shaping the future of HE.

1. Introduction

This Transnational report includes the findings of the desk and field research (needs analysis) conducted by five partner countries namely Cyprus, the Netherlands, Greece, Ireland and Belgium. This report serves as the foundation for Work Package 2 (WP2) of the project consortium. It presents the national and EU findings, compiled through literature review and field research (needs analysis) with target groups in the partner countries. Building on these results, WP2 will focus on developing the next project deliverables, particularly a Practical Toolkit. This toolkit will equip HE academics with a collection of guidelines on how to leverage the power of AI to enhance their professional and pedagogical practices.

2. Methodology

The methodology used to develop the National Report of each country comprised desk and field research (needs analysis) in the partner countries. The desk research aimed to review the national and EU literature to identify current practices, case studies, and principles related to AI tools and approaches for professional and pedagogical practice. It was guided by the following research questions:

Research Question 1: *What are the current applications of AI-based tools for professional and pedagogical practice in HE?*

Research Question 2: *What are the risks of AI-based tools in HE teaching and learning?*

Research Question 3: *What is the impact of AI use on university teachers' and university students' teaching and learning process?*

For the desk research, the methodology employed is the Systematic Literature Review (SLR). SLR uses systematic and explicit methods to identify, select and critically appraise relevant research. In this regard, it can assist researchers in reviewing, evaluating, and synthesising existing literature on a particular topic by providing rigorous, transparent and replicable search outcomes. This SLR has been supported at several points in the process by the AI tools, specifically ASReview¹, as explained below. The guidelines for the SLR were

¹ <https://asreview.nl/>

developed by UNIC, and all organisations contributed by providing their feedback. Based on the guidelines provided, the databases used for the identification phase were the following: EBSCO, Google Scholar, Web of Science, ScienceDirect and ERIC. In the searches in the databases, using the search strings in **Figure 1**, the filters applied were from 2018 to March 2024 for the publication period and English and/or national ones for the language. No filters by document type were applied, however, only journals, papers in conference proceedings, thesis/dissertations and grey literature (reports, working papers, government documents, white papers, etc.) were included. Book chapters were excluded. Each partner country conducted the literature review in their country and other EU countries as defined in the Research Guidelines. Therefore, the search strings were amended accordingly each time to reflect the corresponding country. University of Nicosia and CARDET searched for relevant results concerning Cyprus, Romania, Serbia, Portugal and Italy, University of Groningen with the Netherlands and Spain, University of Dublin with Ireland and Germany, University of the Aegean with Greece, Sweden and Norway and ALL Digital with Belgium, Estonia and Finland.

Search Strings	Search TERMS
1 AI applications in professional practice in Cyprus	"AI application*" AND "professional practice" AND "Cyprus"
2 AI-enhanced Teaching and Learning in Cyprus	("AI-enhanced Teaching" OR "AI-enhanced Learning") AND "Cyprus"
3 AI-based Assessment Tools in Cyprus	"AI-based" AND "Assessment Tool*" AND "Cyprus"
4 AI-driven Educational Analytics in Cyprus	"AI-driven" AND "Educational Analytics" AND "Cyprus"
5 Pitfalls of AI-based education tools in Cyprus	"Pitfalls" AND "AI-based" AND "education tools" AND "Cyprus"
6 Privacy issues with AI in education in Cyprus	"Privacy issue*" AND "AI" AND "education" AND "Cyprus"
7 Bias in AI-based learning systems in Cyprus	"Bias" AND "AI-based" AND "learning system*" AND "Cyprus"
8 Accountability of AI in teaching in Cyprus	"Accountability of AI" AND "teaching" AND "Cyprus"
9 Security risks in AI-based learning platforms in Cyprus	"Security risk*" AND "AI-based" AND "learning platform*" AND "Cyprus"
10 Trust issues with AI in teaching and learning in Cyprus	("Trust issue*" AND "AI" AND ("teaching" OR "learning")) AND "Cyprus")
11 Lack of transparency in AI algorithms in Cyprus	"Lack of transparency" AND "AI algorithm*" AND "Cyprus"
12 Student data protection and AI in Cyprus	"Student data" AND "protection" AND "AI" AND "Cyprus"
13 Social implications of AI in education in Cyprus	"Social implication*" AND "AI" AND "education" AND "Cyprus"
14 Dependence on AI in teaching practices in Cyprus	"Dependence on AI" AND "teaching practice*" AND "Cyprus"
15 Reliability and validity issues in AI assessments in Cyprus	("Reliability issue*" OR "validity issue*") AND "AI" AND "assessment*" AND "Cyprus"
16 Legal challenges of AI in education in Cyprus	"Legal challenge*" AND "AI" AND "education" AND "Cyprus"
17 Pedagogical concerns with AI integration in Cyprus	"Pedagogical concern*" AND ("AI" OR "artificial intelligence") AND "integration" AND "Cyprus"
18 Accessibility of education with AI in Cyprus	"Accessibility of education" AND "AI" AND "Cyprus"
19 AI-driven curriculum development in Cyprus	"AI-driven" AND "curriculum development" AND "Cyprus"
20 Student learning experience with AI in Cyprus	"Student learning experience" AND "AI" AND "Cyprus"

Figure 1: Search string and search terms.

All the papers found after searching in relevant databases were downloaded in RIS format. In the screening phase, the titles and abstracts of the documents were read to see if they fit the eligibility criteria. For this process, partners used ASReview, developed by the Utrecht University which is an AI tool to assist in the conduct of systematic reviews (Utrecht University, 2023). This tool helps the researchers to efficiently identify the most relevant studies for their work while maintaining transparency. Researchers import their data into ASReview, introduce some prior knowledge (that is manually classify some records as “relevant” or “irrelevant” to warm up the model) and set a stopping criterion. The stopping point is set based on factors like the estimated number of relevant papers, a change in the trend of identified records, or time constraints (Cormack & Grossman, 2016). Thus, different stopping strategies are available: stopping after a set period, after encountering a certain number of irrelevant records in a row, or a combination of both. As the researchers start screening and classifying records as “relevant” or “irrelevant”, the tool “learns” from the researcher’s system and prioritises displaying records with a higher likelihood of relevance. For this literature review, the stopping criteria established were mixed depending on each partner researcher’s decision. **Figure 2** shows the records identified from all partner countries through searching in databases.

Literature Review Databases

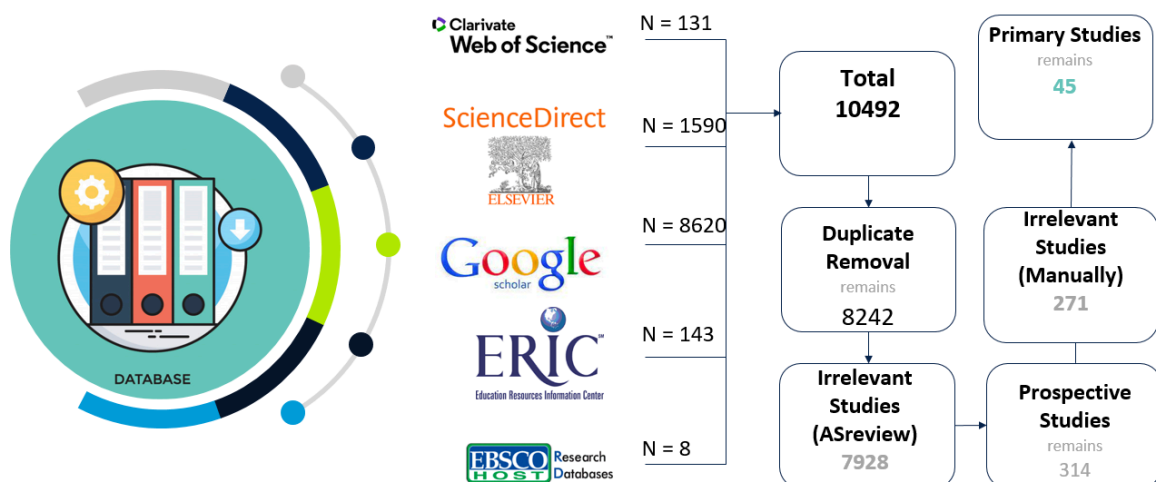


Figure 2: Records identified through searching in databases.

Once the researchers observed that there were no additional relevant data (as described above), they proceeded with the second screening, with the relevant records, using the following exclusion reasons:

- **Reason 1: Technologies that did not meet the research context.** In general, studies about technologies related to Big Data, Machine Learning, Virtual Reality and Augmented Reality without reference to AI were excluded.
- **Reason 2:** Papers that did not fall in the context of HE.

For all relevant records, the researchers worked manually to collect relevant data from the studies finally included. The coded data were entered into an Excel spreadsheet and were classified into several categories including the year of study, country, institution in which research was conducted, DOI reference, purpose of study, dataset, AI tools, target group, number of citations, relevant findings, and case study. **Figure 3** presents this process.

	Year Study	Country	Institution where research was conducted	DOI REFERENCE	Study Purpose	Dataset (if available)	AI Tools	Target group	Relevant Findings	
1										
2	An integrated framework for developing and evaluating an automated lecture style assessment system	2023	Cyprus	Cornell University	https://doi.org/10.48550/arxiv.2312.00201	The study aims to develop and evaluate an integrated system that provides an automated evaluation of an instructor' lecture style. This system aims to help	The proposed application analysed and extracted measurable biometric characteristics from video cameras and audio sensors using machine learning.	evaluation system	HE students and lecturers	The results indicated that the system effectively provided automated feedback that participants received well. It performed comparably to humans and, in some cases, even outperformed them

Figure 3: Sample of Excel spreadsheet

A literature review was also followed to collect relevant national/EU case studies to provide evidence-based paradigms of AI tools integrations in HEIs, their affordances and challenges for professional and pedagogical practices. These case studies were documented in a table available in a shared Excel spreadsheet. The information collected was some basic information regarding each case (e.g. university, HE institution where the case takes place, course and subject domain and target group) and some descriptive information (e.g. AI tool used, detailed description of what happened, lessons learned -

actual results, implications for practice, researchers' insights and personal statement).

In addition, to better understand the current needs and challenges of integrating AI into each partner's country context, partners gathered the target groups' opinions through an online questionnaire for professional and pedagogical practices. The questionnaire was completed by **259 members (132 educators and 127 students)** of the project's target group. The participants were recruited through emails to staff and students at the partners' countries institutions/organisations as well as through social media posts. The participants who filled in the survey have the following profiles:

Average Age: 34

Gender: 151 Female, 93 Male, 9 Non-binary, 6 Didn't say

The collected data are analysed, presented and discussed accordingly in Section 3.1.3. **Figure 4** below summarises the methodology that was applied as part of the INFINITE approach.

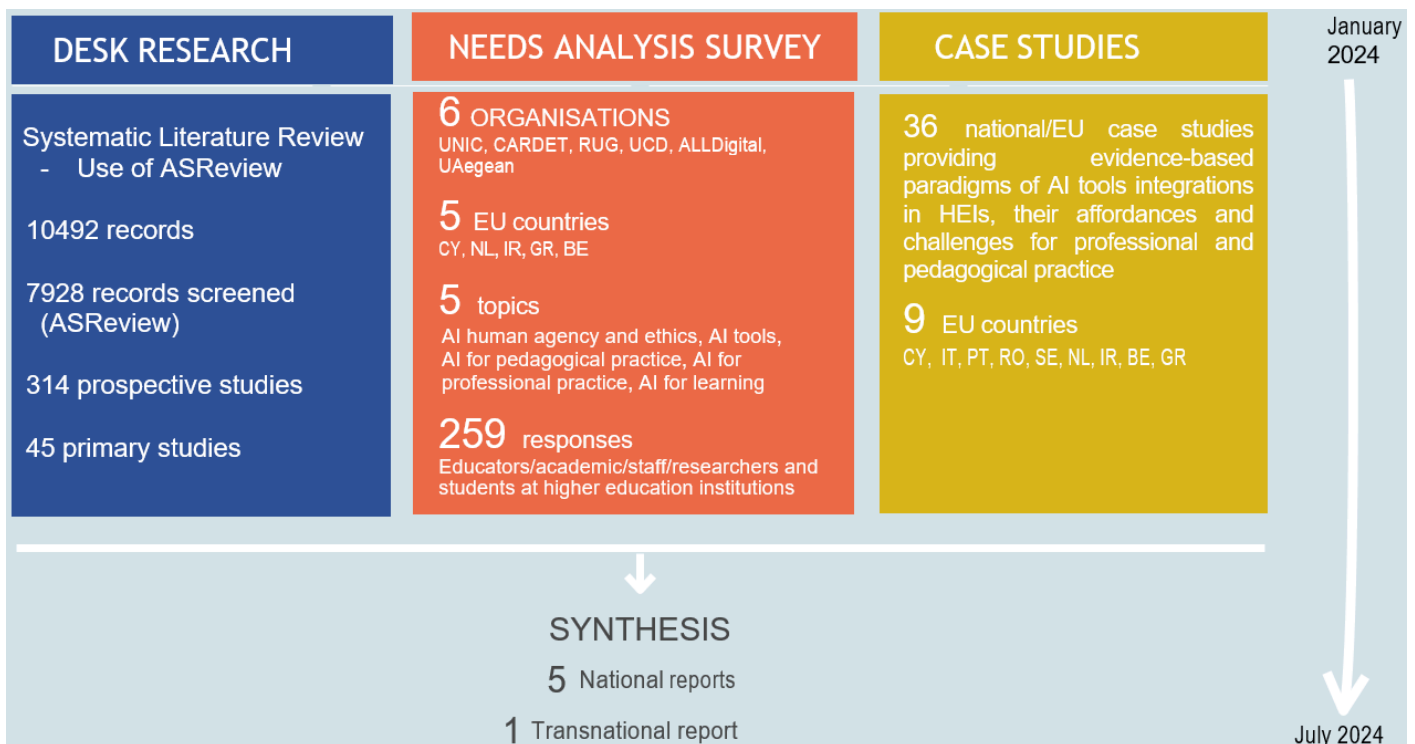


Figure 4: INFINITE Research Methodology.

3. Findings

This section analyses data from desk research and a needs analysis survey to explore current practices, case studies, and key principles regarding AI tools and methodologies in partner countries' professional and pedagogical settings. Insights from the literature review and online questionnaire are incorporated.

3.1 Desk Research

The following section presents key findings from the SLR, highlighting current practices, case studies, and principles related to AI tools and approaches in professional and pedagogical settings across Cyprus, Greece, the Netherlands, Ireland, Belgium, Germany, Sweden, Norway, Spain, Italy, Serbia, Romania, Portugal, and Finland.

3.1.1 Current state of AI-based tools in the context of HE

The national-specific and EU-wide data resulting from the SLR are presented by addressing the following key research questions:

- **What are the current applications of AI-based tools for professional and pedagogical practice in Higher Education?**

The landscape of HE is rapidly evolving with the integration of several AI tools. These tools are impacting HE influencing both professional practices, the way institutions operate, and pedagogical practices, how students learn and educators teach.

Regarding **professional practice**, in the administrative sphere, AI streamlines daily tasks, freeing up valuable staff time and minimising errors. Tools automate scheduling, attendance tracking, resource allocation, and even document management tasks related to academic writing. Beyond automation, AI-driven

data analytics empower data-driven decision-making. These tools translate student performance and resource utilisation data into actionable insights that inform strategic planning, resource allocation, and curriculum development. Furthermore, AI is transforming research by assisting with literature reviews, data analysis, and even tasks like generating images or converting speech to text, accelerating research progress and uncovering new avenues for exploration.

When it comes to **pedagogical practices**, it is evident that AI is revolutionising how students learn. HE institutions leverage AI to personalise learning journeys by tailoring content and instruction to individual student needs. AI-powered tools facilitate assessment and feedback, offering automated or AI-assisted options that support student progress. Additionally, AI goes beyond content delivery by creating and curating engaging educational materials. Student support is also being transformed through the use of virtual tutors, chatbots, and assistive technologies, fostering accessibility and inclusivity for a diverse student body. AI also enhances engagement and interaction through innovative tools like recommendation engines that suggest relevant courses, and exploratory learning environments that dynamically adapt to student needs. These tools, combined with AI chatbots that facilitate communication and collaboration, all contribute to the development of critical thinking, problem-solving, and language-learning skills.

Following the desk research conducted by the consortium, a multitude of AI tools that are transforming HE has been provided. Educational chatbots like Ada and Botsify answer student questions, while AI-driven data analytics tools inform resource allocation. Intelligent Tutoring Systems (ITS) like Dodona personalise learning paths, and AI teaching assistants provide additional support. For student engagement, recommendation engines suggest relevant courses, while exploratory learning environments utilise AI to adapt to student needs. These are just a few examples (Van Elsen, 2023), and the possibilities continue to grow as AI integration in HE expands.

National reports reveal a dynamic approach to AI integration in pedagogy, particularly in Ireland and Belgium. Ireland’s national policy, "AI – HERE FOR GOOD," exemplifies how such policies support responsible AI development and its ethical use in education, a model worth considering for other countries. Similarly, the National Convergence Plan² was adopted in Belgium for the development of AI with concrete actions. **Figure 5** illustrates a strategy for AI Tools for Professional and Pedagogical Practice.

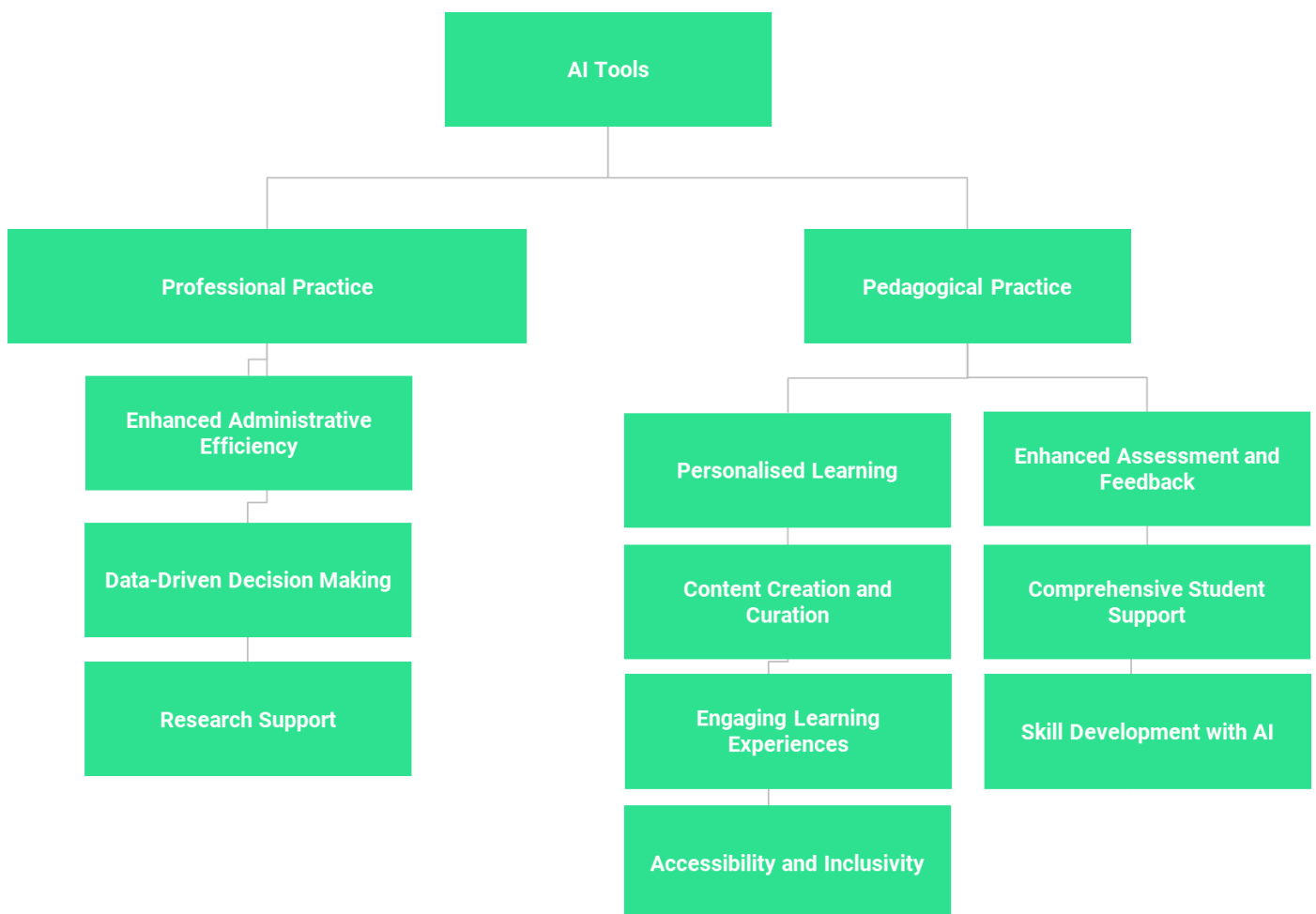


Figure 5: AI Tools for Professional and Pedagogical Practice.

² Plan national de convergence pour le développement de l'intelligence artificielle (2012). Retrieved from https://bosa.belgium.be/sites/default/files/content/documents/DTdocs/AI/Plan_national_de_convergence_pour_le_developpement_de_lintelligence_artificielle.pdf

- **What are the risks of AI-based tools in Higher Education teaching and learning?**

While AI offers exciting possibilities for teaching and learning, its integration into HE comes with potential risks that warrant consideration (Van Schoors & Fastré, 2024).

Ethical and Legal Considerations:

A significant concern is the potential violation of student privacy. AI tools often rely on vast amounts of student data, raising questions about data security and how this data is used. There's also the risk of perpetuating existing biases. AI algorithms trained on biased datasets can amplify educational inequalities and lead to unfair outcomes for certain student groups. This necessitates careful design and monitoring of AI systems to ensure they promote fairness and ethical educational practices.

The emergence of generative AI tools like Chat GPT has brought academic integrity into question. Unauthentic use of these tools for assignments can undermine the foundations of honest learning. Institutions need clear policies and guidelines to address this new challenge. Additionally, the "black box" nature of some AI models raises concerns about accountability. With opaque decision-making processes, it's difficult to understand how AI systems arrive at their conclusions, making it challenging to hold them accountable for potential negative impacts.

Technological and Implementation Challenges:

Effective implementation may be hampered by the intricacy of some AI models. AI systems may also be susceptible to data breaches and hacks, endangering student privacy and perhaps interfering with academic pursuits. Since staff training and infrastructure upgrades are necessary for successful integration, implementing AI technologies may require a large investment of resources. Additionally, unequal access to AI tools due to cost or infrastructure limitations can exacerbate existing educational disparities between institutions and countries.

Educational Considerations:

Over-reliance on AI tools also poses an important risk. Dependence on AI for tasks like grading or assessment could lead to reduced human oversight and limit the development of critical thinking skills among both students and educators. Additionally, educators may resist adopting AI-based assessment methods due to unfamiliarity or scepticism about the technology. This highlights the importance of ongoing professional development to equip educators with the skills and knowledge to effectively integrate AI tools into their teaching practices. Finally, overdependence on AI could limit the development of critical thinking, problem-solving, and even grading skills among educators themselves.

Despite variations in national reports, all countries emphasised three common challenges in integrating AI into higher education: protecting student privacy with data-driven AI tools, mitigating bias in AI algorithms to ensure fair learning, and avoiding overreliance on AI.

- **What is the impact of AI use on university teachers' and university students' teaching and learning processes?**

AI presents a fascinating and complex landscape for HE. On the positive side, AI can revolutionise learning by personalising experiences, automating tasks, and offering advanced assessment techniques. AI-powered tools can tailor content and feedback to individual student needs, allowing educators time for more personalised interactions. Additionally, AI can analyse student performance data to identify areas for improvement and provide targeted interventions. Furthermore, AI-driven simulations can create immersive learning experiences that boost engagement and understanding. Finally, integrating AI into programmes helps prepare students for the future by equipping them with the critical thinking and problem-solving skills needed in an AI-driven world.

However, alongside these possibilities lie significant challenges. As identified by the researchers when looking for the challenges related to the use of AI tools in teaching and learning, overreliance on AI for teaching and assessment could lead to a decline in human interaction and stifle pedagogical innovation. Additionally, AI's focus on standardised testing might overshadow the development of crucial skills like creativity and critical thinking. Ethical considerations regarding data privacy, algorithmic bias, and potential commercialisation necessitate the development of robust frameworks to ensure fair and equitable educational practices. The role of educators might also be redefined, requiring careful consideration to maintain a balance between AI and human expertise. Finally, unequal access to technology and the need for educators to develop new digital literacy skills could exacerbate existing educational inequalities. By carefully navigating these challenges and implementing AI strategically, HE institutions can harness its power to enhance student learning and prepare them for the future.

3.1.2 Best practices - Case studies

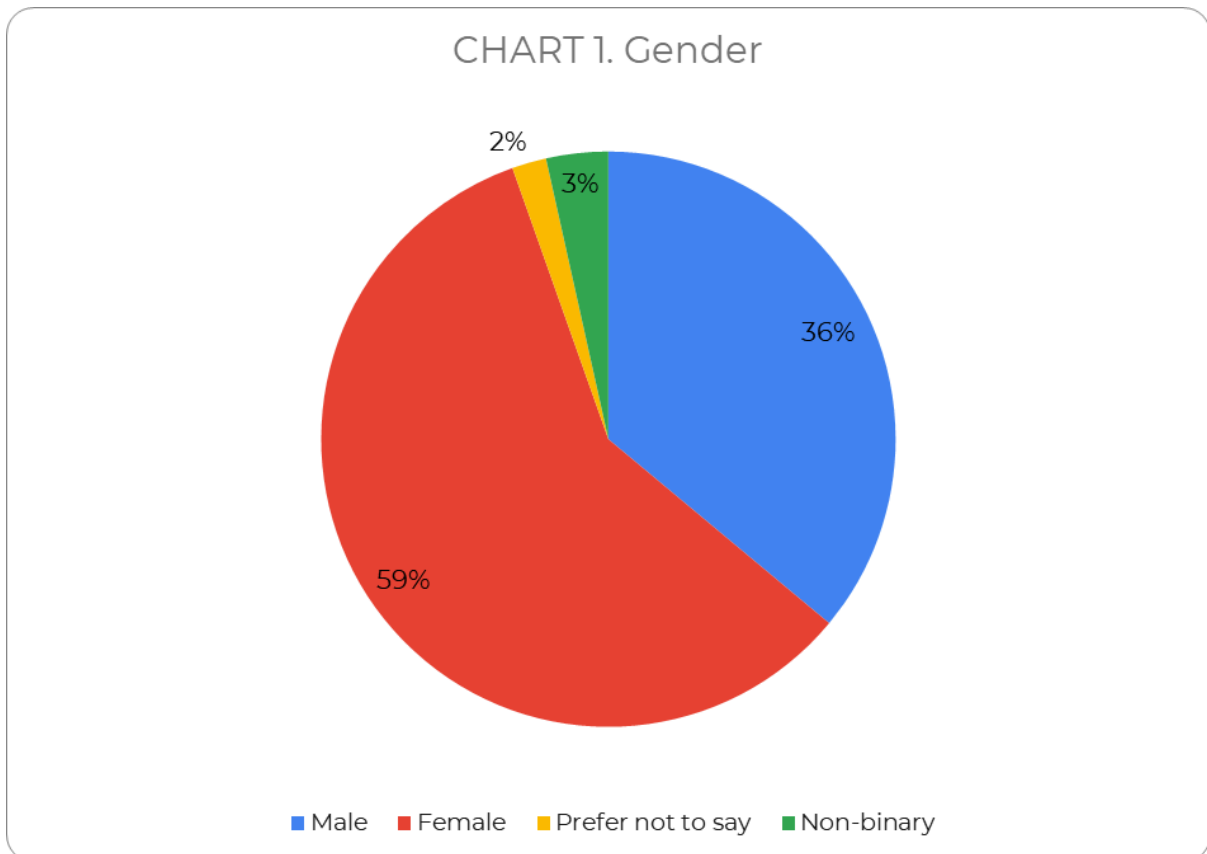
As part of the desk research, the partners have identified 36 case studies in total, providing evidence-based paradigms of AI tools integrations in HEIs, their affordances and challenges for professional and pedagogical practices. These case studies are documented in the table available in the shared [Excel file](#) titled "Collection of Case Studies."

3.2 AI Needs Analysis Survey

This section presents the results obtained from each survey section for both groups of participants: the HE community comprising 259 participants in total with 132 staff and 127 students.

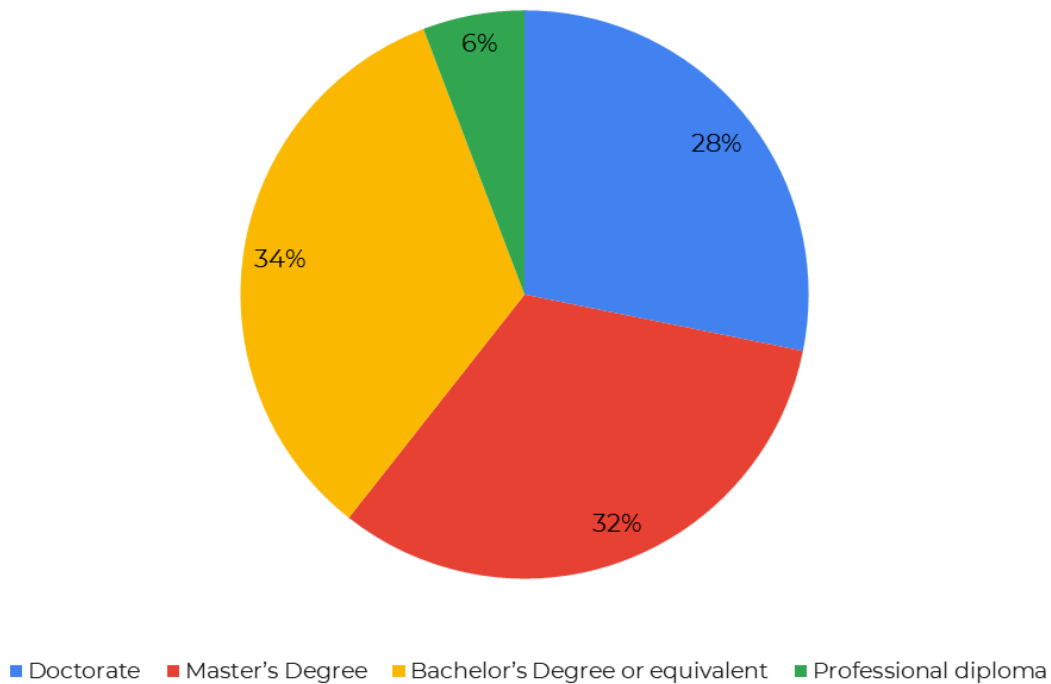
3.2.1 Demographic Data

The participants of this study came from a diverse range of backgrounds. Out of the total of 259 participants, 151 identified as female, 93 as male, 9 as non-binary and 6 preferred not to say (Chart 1).



Among the 259 participants, we see a variety of educational backgrounds. The largest group, 87 people (34%), hold Bachelor's degrees. Close behind, 84 participants (32%) have Master's degrees. Seventy-three participants (28%) have Doctorate degrees, and 15 participants (6%) hold Professional Diplomas. This shows that most of our participants have advanced degrees, indicating a highly educated group (Chart 2).

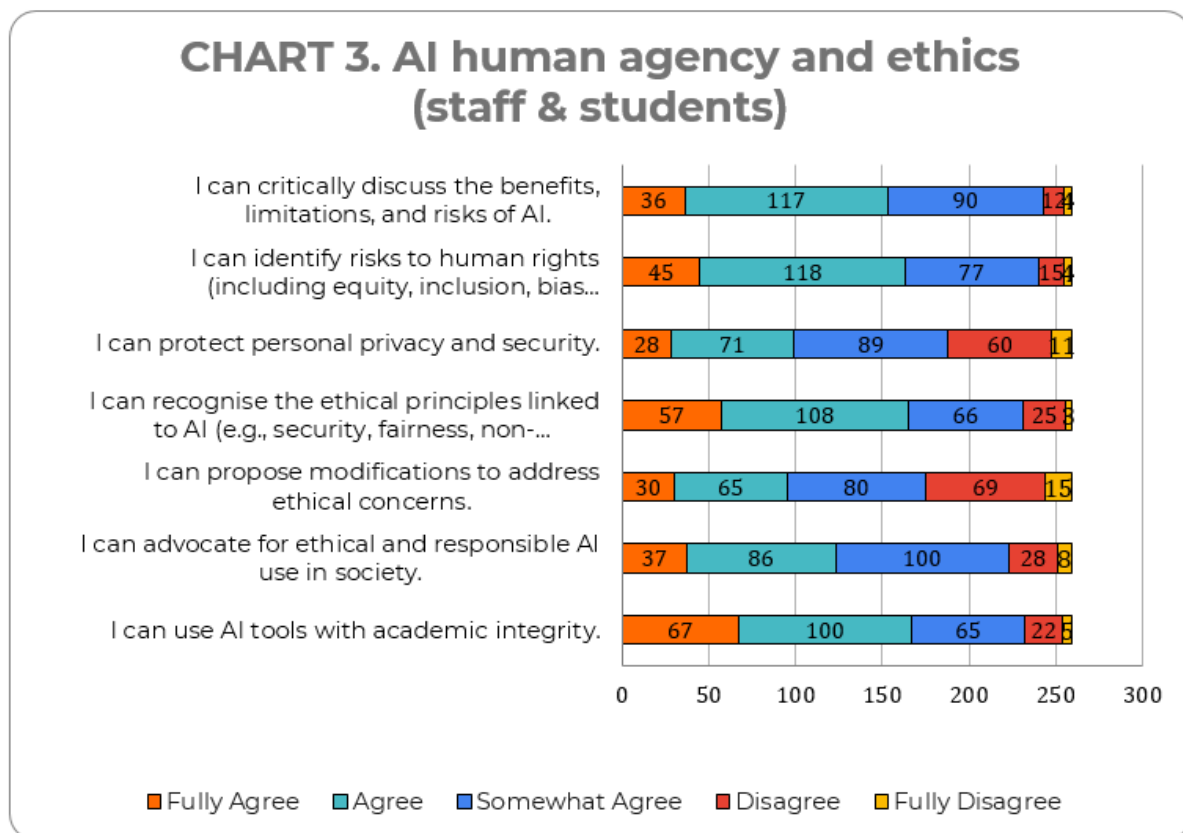
CHART 2. Highest Degree Level



3.2.2 AI human agency and ethics [common]

Participants, including both staff and students, were asked to rate their agreement on seven items related to AI, human agency, and ethics using a 5-point Likert scale, where "Fully agree" is rated as point 5 and "Fully disagree" as point 1. The data shows that the majority of the participants agree with the statements "I can critically discuss the benefits, limitations, and risks of AI", "I can identify risks to AI (including equity, inclusion, bias amplification).", "I can use AI tools with academic integrity." and "I can recognise the ethical principles linked to AI (e.g., security, fairness, non-discrimination, the right to privacy, data protection, transparency, explainability, etc.)." Additionally, most of the participants expressed somewhat agreement levels for the statements "I can protect personal privacy and security.", "I can advocate for ethical and responsible AI use in society.", and "I can propose modifications to address ethical concerns.". This suggests a widespread consensus among participants regarding the importance of ethical AI practices, safeguarding

personal privacy, and engaging in critical discourse on AI-related issues.



3.2.3 AI tools [common]

Charts 4 and 5 reveal valuable insights into respondents' perceptions of AI tools. The majority of staff (48 out of 132) consider themselves aware of publicly available AI tools whereas the majority of students (53 out of 127) are moderately aware (somewhat agree). Also, the majority of both staff and students emphasised the importance of testing these tools, demonstrating a moderating focus on proper evaluation. Additionally, respondents exhibited confidence in finding publicly available AI tools that meet their specific needs. However, a gap emerges in their comfort level with creating custom AI tools. Specifically, most of the staff (42) strongly disagree and most of the students (41) disagree with the possibility of modifying open-source tools. This suggests a potential need for further development in this area. Addressing

these challenges through targeted education and resource allocation could facilitate greater adoption and utilisation of AI tools in educational settings.

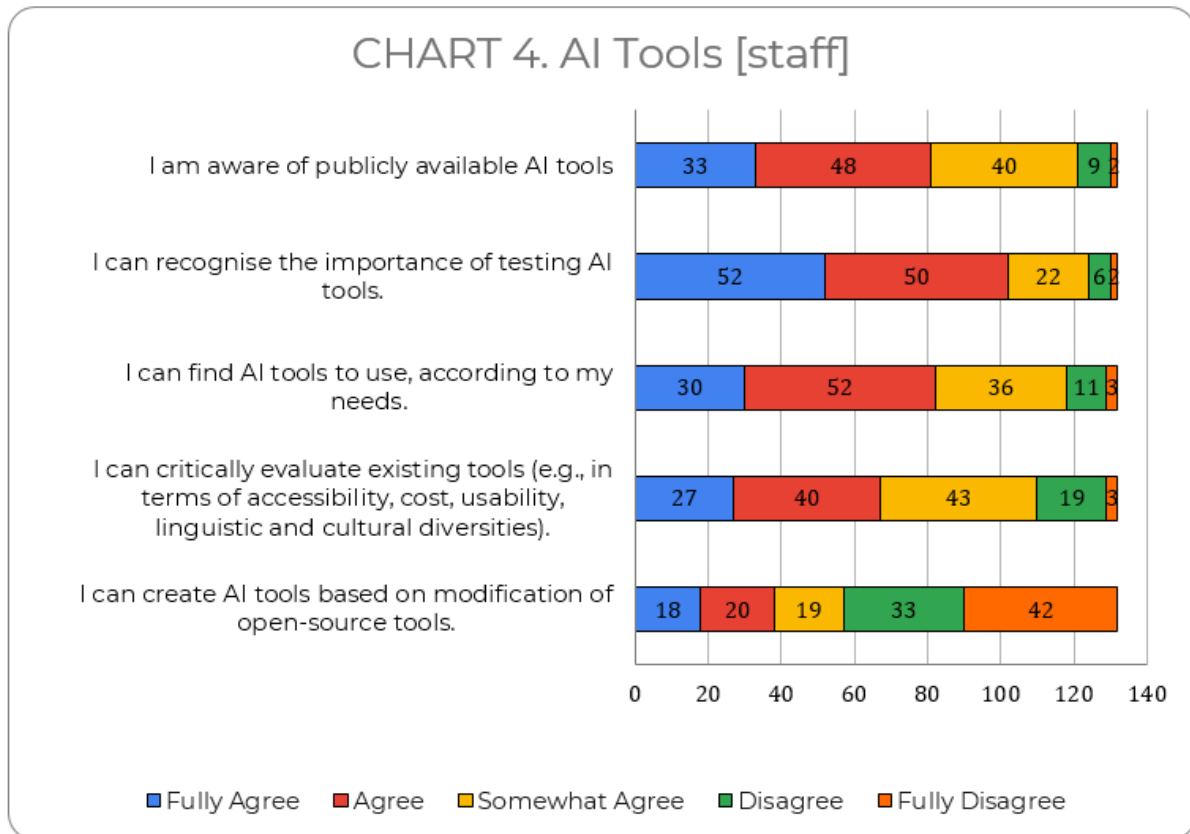
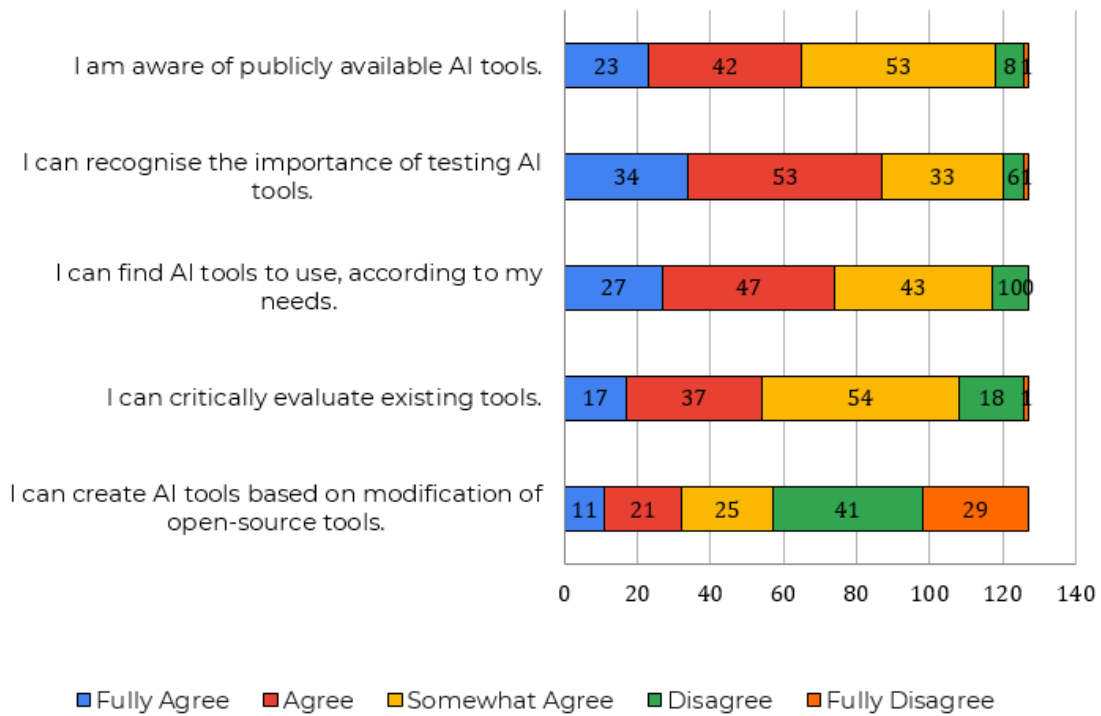


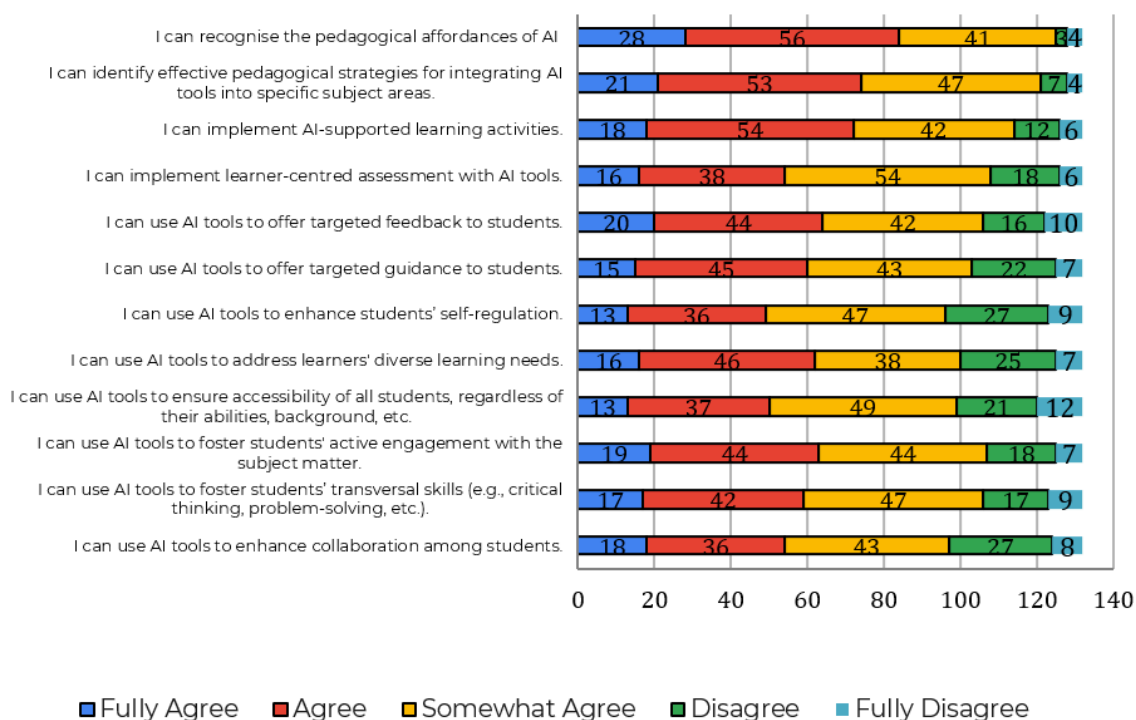
CHART 5. AI Tools [students]



3.2.4 AI for pedagogical practice [for staff]

Educators express agreement in their ability to identify effective strategies, implement AI-supported learning activities, and recognise the pedagogical affordances of AI. However, as the responses show, educators are uncertain and reluctant about how AI could be further used to implement learner-centred assessment, offer targeted feedback and guidance to students, and foster students' active engagement and transversal skills. Similarly, they do not feel confident enough in using AI tools to enhance students' self-regulation and collaboration among students and to ensure accessibility and accommodation of students' diverse learning needs.

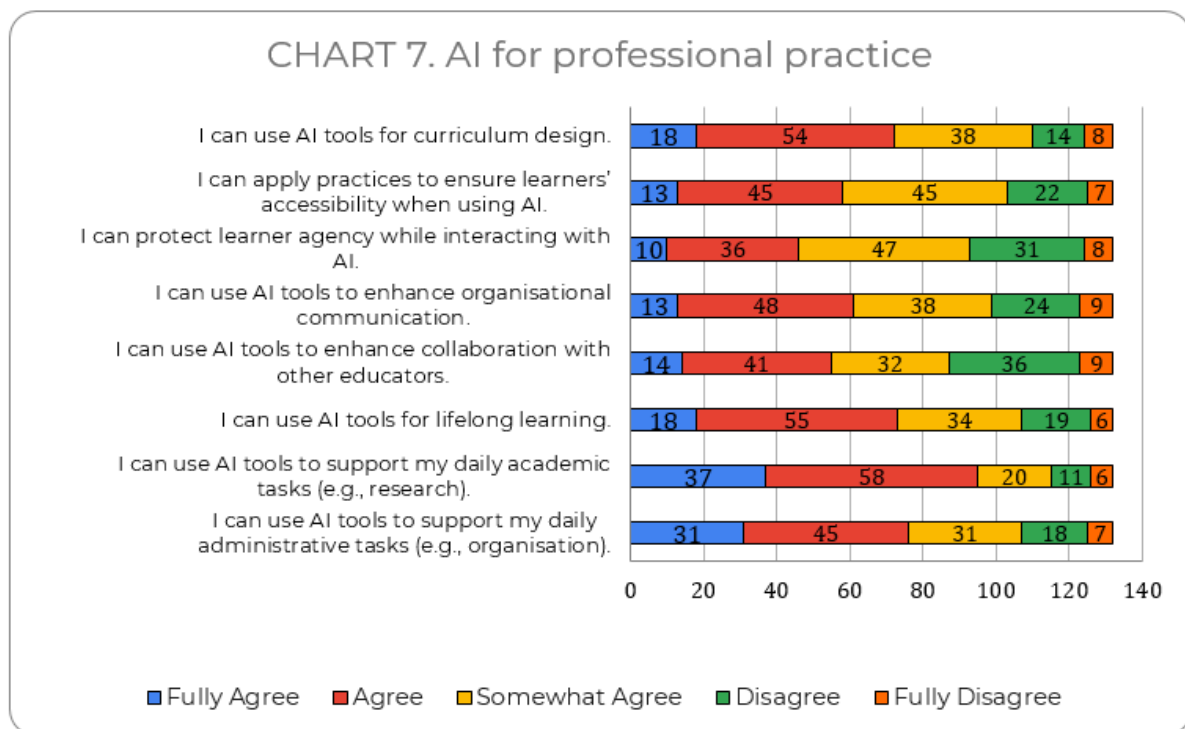
CHART 6. AI for pedagogical practice



3.2.5 AI for professional practice [for staff]

According to Chart 7, there is a range of opinions among staff regarding the use of AI tools for research tasks. While 58 individuals indicated that they can apply practices to ensure learners' accessibility when using AI (13 fully agree and 45 agree), another 45 individuals are not sure and the rest of them do not agree. Similarly, although educators showed promise for using AI in organisational communication (13 fully agree/48 agree), some uncertainty and disagreement exist as well (38 somewhat agree, 24 disagree and 9 fully disagree). Providing resources on how AI tools can enhance communication could address this gap. However, interest in other applications of AI is more pronounced. Ninety-five and eighty-six respondents highlighted AI's potential for supporting their daily academic and administrative tasks respectively. It is noteworthy to mention that although a significant number (73) felt confident using AI for continuous learning throughout their careers, 34 are unsure of these opportunities while 25 disagree or fully disagree.

Educators' responses on AI collaboration with other educators were mixed (55 agree/fully agree vs 68 disagree/somewhat agree). While a slight majority sees value, many of them are not confident. This suggests educators need more information and practical examples to feel confident that AI can enhance collaboration among them. Additionally, 72 respondents recognised AI's potential in curriculum design by strongly agreeing and agreeing with the relevant statement. It is important to mention that 47 individuals somewhat agree that they can protect learners while interacting with AI while 39 (31 disagree and 8 fully disagree) expressed concerns about students' safety when AI is involved, highlighting the importance of ethical considerations in AI use within professional contexts. Overall, these findings indicate that while staff members are somewhat open to AI, there is a strong emphasis on responsible and ethical use.

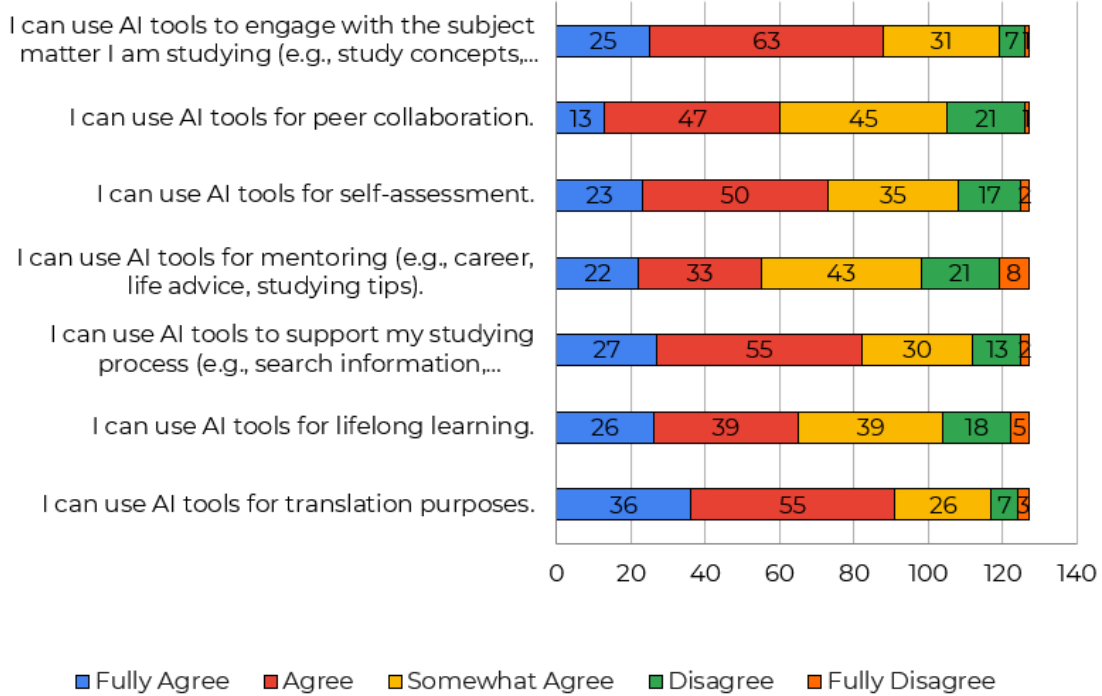


3.2.6 AI for learning [for students]

The answers provided by HE students regarding using AI tools for learning purposes are promising (Chart 8). Support for the studying process such as searching for information and writing

an essay receives high rates of agreement with 64.6% of the students either agreeing or strongly agreeing about this. Additionally, approximately the same number of participants (69.3%), agreed or fully agreed that they could use AI tools to engage with the subject matter they are studying. The translation category also received a high percentage of agreement with 71.7% of students agreeing or fully agreeing, indicating widespread awareness of translation tools and suggesting a positive outlook for AI translation adoption. More than half (57.5%) of the respondents agreed or fully agreed they could use AI tools for self-assessment. However, while most of the respondents (47.2%) either agree or strongly agree that they could use AI tools for peer collaboration, 35.4% of the students somewhat agreed with the statement, indicating a potential for growth in their confidence and experience with these tools in this context. This also suggests potential but highlights a need for educational initiatives. Responses regarding AI mentoring showed cautious optimism. While 43.3% of the respondents either agreed or strongly agreed that they could use AI tools for mentoring, many (33.9%) expressed reservations about the AI's role compared to human mentors or limitations in specific areas. Importantly, the HE students equally agree and somewhat agree (30.7% for each statement) regarding the use of AI tools for lifelong learning. While the positive responses suggest growing acceptance of AI in lifelong learning, others are cautiously optimistic, maybe because they are not yet either fully confident or aware of using AI tools for a specific purpose effectively. This highlights the importance of initiatives that can help students develop the skills and knowledge they need to leverage AI tools for lifelong learning.

CHART 8. AI for Learning [students]



3.2.7 Open-ended questions - additional comments [common]

In this section, we delve into the insights shared by participants in response to open-ended questions. Their comments shed light on the challenges they encounter when integrating AI into their daily educational practices. To best understand these obstacles, we have categorised their responses into several key themes. Each theme is presented alongside illustrative quotes from the participants themselves, providing a firsthand perspective on the complexities of AI implementation in education. More precisely, participants provided insights into various challenges hindering the integration of AI into their daily practices, categorised into five (5) theme categories. Each category represents distinct challenges participants in the partner countries face when integrating AI into their respective fields or practices.

Ethics and Budget Concerns

Cyprus

- "Ethical issues mainly and budget (P1)."
- "Ethical issues - copyright (P2)."
- "Concerns about data security and privacy since AI systems require large amounts of data (P1)."

Ireland

- "AI is invasive, care should be given to educate educators and students about privacy risks (P1)."
- "Academics must navigate ethical and legal considerations when using AI, especially in sensitive areas such as healthcare or social sciences. Issues such as data privacy, algorithmic bias, and the potential for unintended consequences need to be carefully addressed to ensure responsible AI use (P2)."

Netherlands

- "Sometimes it is unclear to me what is ethically and responsibly 'correct' with the use of AI for my learning. Sometimes I worry that because of using AI, my writing skills will decrease. I wonder how I can better use AI so that I can better myself in certain skills and do that ethically and responsibly (P1)."
- "Currently, I lack knowledge of AI tools and examples beyond ChatGPT. We lack expertise and examples of what it could mean for education in our context. Also, it is unsure how to deal with this in terms of safety and privacy. Also, I'm not sure how to get safe access for all students, licences etc... (P2)."

Greece

- "How my data is going to be used (P1)."

- "I believe that the ethical issues regarding the use of artificial intelligence and the education of children in the correct use of it are very important (P2)."

Belgium

- "Find reliable and not expensive tools (P1)."
- "knowing more about the legal and ethical aspects of AI - knowing more about using it to analyse and foster language learning and education with students (P2)."

Across all five countries, educators expressed concerns about the ethical implications of using AI in professional and pedagogical practices. Data privacy, algorithmic bias, and the potential for misuse were all highlighted. Budgetary limitations were another major concern, with educators worried about the affordability of AI tools and the cost of ensuring safe access for students. Copyright concerns also arise within the ethical realm. In addition, some educators expressed a fear that AI could negatively impact essential skills, such as writing.

Training and Time Constraints

Cyprus

- "Lack of time to catch up with AI tools that evolve fast (P1)."
- "Not enough training (P2)."
- "Additional need for specialised training for my team members (P1)."

Ireland

- "Learning and implementing AI techniques require significant time and effort, which may detract from other academic responsibilities such as teaching, publishing, and grant writing. Balancing these competing demands can be a major obstacle for academics interested in integrating AI into their practice (P1)."

- "The lack of knowledge and awareness about AI among peers and wider society (P2)."
- "Difficulty in finding time and resources for acquiring the necessary skills and knowledge to leverage AI effectively (P3)."

Netherlands

- "The number of new tools coming out every day and their price. I don't have time to keep up to date (P1)."
- "One challenge is that I need to clear out when the use of AI is against Academic Integrity to use properly and a second challenge is to expand my knowledge on how to use AI to facilitate my learning and research work. (P2)."
- "not aware of all AI possibilities (P3)."

Greece

- "Lack of "real" knowledge. Knowledge regarding AI is only superficial to the very most non-Computer-Scientists (P1)."
- "There is no official training or informing (P2)."
- "Lack of time, I have to constantly follow the very fast evolution of a.i. (P3)."
- "Lack of time to explore its full potential (P4)."

Belgium

- "There is a wide range of tools for AI. Selecting and testing them is very time-consuming (P1)."
- "Lack of time. Fast evolving topic (P2)."
- "training on specific IA tools (best practices to be more efficient), pedagogical training how students could discover limits, critics,..., learning how, as a teacher, we can help students to think critically about IA, training on which AI for which situation, training to help us use IA in our daily work as teachers (P3)."

Educators across all countries highlighted a significant challenge in keeping up with the rapid pace of AI development. The constant stream of new tools and the fast evolution of the field make it difficult for them to find the time to learn and implement these technologies effectively. Compounding this challenge is a lack of adequate training. Educators reported feeling inadequately prepared, and many emphasised the need for both basic and specialised training for themselves and their students. This specialised training is crucial for educators to fully grasp the potential of AI and leverage it to enhance their teaching practices as well as for students to develop the necessary skills to navigate this increasingly AI-driven world.

Effectiveness and Reliability

Cyprus

- "Some of the information that AI gives is false. So I must always double-check (P2)."
- "Output correctness, data privacy, copyright infringement (P1)."
- "Concerns about accuracy and reliability of information (P2)."

Ireland

- "Still, they are behaving artificially, they are not too specific yet (P1)."
- "The answers provided by AI are sometimes incorrect or generic (P2)."
- "Hard to trust AI before you do your research (P3)."
- "AI is invasive, care should be given to educate educators and students about privacy risks (P4)."

Netherlands

- "It is still not very reliable to use at this stage of its development, for example with regards to finding sources for research. As such it can make it a liability (P1)."
- "That there are mistakes in the answers that you get, although it might be hard to recognise them sometimes (P2)."
- "It's limitations on its answers, it's lack of specificity on the content sometimes. Not knowing where information is coming from (P3)."

Greece

- "Current AI tools are not reliable (P1)."
- "Scientific validity and reliability (P2)."
- "It is not reliable (P3)."

Belgium

- "AI is not always right so sometimes it makes something that is simple more confusing (especially for ChatGPT) (P1)."
- "Find reliable and not expensive tools (P2)."
- "The lack of precision in the answers provided by the AI (P3)."

Beyond the ethical, time and training challenges, educators and students expressed concerns about the effectiveness and reliability of AI tools themselves. A recurring issue was the accuracy of AI-generated information, with respondents highlighting the need for fact-checking to avoid misleading students. Concerns were also raised about the lack of specificity in AI responses and the potential for unreliable source findings in research tasks. These limitations underline the importance of careful evaluation when using AI in education. Educators must be critical of the information AI provides and ensure it aligns with their teaching objectives. This critical evaluation extends to students as well. They must learn to critically assess information

encountered through AI, developing essential skills for navigating the increasingly information-rich world.

Educational Adaptation

Cyprus

- "The challenges that I will face are in a practical phase... need to learn all the things around AI (P1)."
- "AI tools need to align with curriculum standards and learning objectives (P2)."
- "Concerns about the applicability of AI tools in early education due to young students' ages (P1)."

Ireland

- "Integration with Curriculum is one of the most important challenges that we face, integrating AI concepts and tools into existing curricula and educational programs can be challenging. Educators may lack the resources, training, or support needed to incorporate AI effectively into their teaching practices, hindering the development of AI-related skills among students (P1)."
- "Provision of personalized feedback (P2)."

Netherlands

- "The line between taking inspiration from AI and letting AI do your work feels like a very thin one at times. It is sometimes hard to determine to what extent I can use AI, as it very quickly feels "illegal"(P1)."
- "One challenge is that I need to clarify when the use of AI is against Academic Integrity to use properly and a second challenge is to expand my knowledge on how to use AI to facilitate my learning and research work (P2)."

Greece

- "Lack of appropriate policies regarding AI integration in compulsory education (P1)."
- "Lack of equipment. The age of children I teach (P2)."

Belgium

- "The quality of the AI tools is not always high enough. besides that, I am concerned about the education of many students. Will they have enough skills to think critically in the future about AI if we teach them to use AI in their development....(P1)."
- "An overview of different AI tools for different educational purposes (P2)."

Respondents across all countries highlighted challenges in adapting their teaching practices to effectively integrate AI. A major concern was ensuring alignment between AI tools and existing curricula to maximise learning outcomes. Additionally, educators expressed a need for practical guidance on implementing AI in the classroom, including considerations for different age groups. The potential impact on student development was also a concern, with some educators worried that overreliance on AI could hinder critical thinking skills. Finally, educators in some countries called for the development of clear policies around AI use in education to ensure responsible integration. These findings highlight the need for ongoing collaboration between educators, curriculum developers, and AI specialists to create a framework for successful AI integration in the classroom.

Specific Needs and Practical Resources

Cyprus

- "I would appreciate a prompts list to be more productive and effective (P2)."
- "Not sure about the liability of the AI tools (P1)."
- "Lack of creativity when you use AI (P2)."

Netherlands

- "I am not aware of existing tools (P1)."
- "Absence of guidelines and lack of knowledge on the intricacies of AI use (P2)."
- "I want to be creative myself first (P1)."

Ireland

- "Integrating AI often requires access to computational resources, such as powerful computers and large datasets, which may not be readily available to all academics. Procuring these resources can be costly and time-consuming, especially for researchers with limited funding or institutional support (P1)."
- "Over-reliance on the AI tools without human oversight or intervention can lead to complacency, disengagement, or loss of critical skills. Balancing the benefits of AI automation with the need for human judgment, creativity, and empathy is a challenge in various domains, such as healthcare, transportation, and finance (P2)."
- "Proficiency in programming languages commonly used in AI development, such as Python, is essential. Educators and students should be able to write code to implement and customize AI algorithms, as well as to work with AI libraries and frameworks (P3)."

Greece

- "Regarding the open access large language models like ChatGPT 3.5 and Gemini, a problem I have pointed out is the limited number of input words as well as the inability to import images, graphs and tables. What about ChatGPT 3.5 the biggest problem is the inability to connect to the internet and the hallucinations it presents regarding scientific article citations. I have encountered hallucinations in Gemini as well and I have made a lot of effort with repeated prompts to get a relevant response, especially regarding valid scientific article information. Also concerning Quillbot AI paraphrasing tool, it does not paraphrase text or phrases in Greek language yet (P1)."
- "Finding the right questions to ask (P2)."
- "The ability to intervene in the code and customise it according to my personal needs for my course. The ability to highlight its biases and inequalities (P3)."

Belgium

- "Don't know how to design a prompt to get the best answers (P1)."
- "Using it by myself and not with other people/taboo in academics seeing AI as a threat and not support (P2)."
- "Lack of practical knowledge on the matter (P3)."

Educators highlighted a range of practical challenges associated with using AI in the classroom. These included concerns about the lack of readily available resources, such as powerful computers and large datasets, which can be cost-prohibitive for some institutions. Additionally, educators expressed a need for more specific tools and functionalities, such as the ability to integrate graphics and access scientific databases. Beyond the technical limitations, some educators are worried about the potential impact of AI on creativity in the classroom. A recurring

theme was the need for practical guidance and support. Educators requested resources to help them design effective prompts, navigate the ethical implications of AI use, and collaborate with colleagues in integrating AI into their teaching practices. These findings highlight the importance of developing user-friendly AI tools and providing educators with the necessary training and support to leverage AI effectively in their classrooms.

4. Discussion

This section compares the results obtained from the survey between HE staff and student participants with the findings from the desk research on AI in HE and is divided into four subsections.

4.1 Recognition of Benefits and Applications

Both the desk research and the AI Needs Analysis Survey illuminate the multifaceted impact of AI on HE. These tools are transforming Higher Education Institutions on two key fronts: professional practice and pedagogical practice. In administration, AI streamlines tasks, frees up staff time, and empowers data-driven decision-making. Research is also accelerated through AI's assistance with literature reviews and data analysis. Pedagogically, AI personalises learning experiences, provides tailored feedback, and fosters accessibility through virtual tutors. AI tools further enhance engagement through recommendation engines and adaptable learning environments, all contributing to the development of critical thinking and problem-solving skills. This highlights the significant potential of AI in HE, transforming both how institutions operate and how students learn. The AI Needs Analysis Survey results further solidify the positive outlook on AI in HE. A strong majority of participants agreed with statements regarding their ability to critically discuss AI's benefits,

limitations, and risks. This demonstrates a widespread recognition of the importance of responsible AI development and ethical considerations. The survey also revealed encouraging signs regarding staff and student comfort with using AI tools and finding publicly available tools that meet their specific needs, particularly for tasks like research, administration, and learning support. Students also showed strong agreement on the value of AI tools for tasks like information search, writing support, subject engagement, and self-assessment. These findings highlight the multifaceted potential of AI in HE, not just for enhancing learning experiences but also for empowering educators and fostering a culture of lifelong learning.

4.2 Common Challenges and Concerns

Desk research identified potential risks associated with AI integration in HE, including ethical concerns around student data privacy, algorithmic bias, and the "black box" nature of some AI models. These findings align with concerns highlighted by participants in the Needs Analysis Survey. While both staff and students demonstrated a strong understanding of ethical principles in AI, the survey additionally revealed a need for increased confidence in protecting personal privacy and advocating for responsible AI use. The desk research also pointed to challenges like the complexity of AI tools and the potential for overreliance. The Needs Analysis Survey results further illuminate these concerns. Educators, while acknowledging the potential of AI for learning strategies, expressed uncertainty about using it for tasks like assessment and collaboration. Students see value in AI for tasks like information search and self-assessment, but the survey highlights the need to address potential overreliance and ensure these tools are used ethically.

4.3 Implications for Educational Practices

The findings underscore the importance of adopting a balanced and multifaceted approach to integrating AI tools into

educational practices. Addressing identified challenges through targeted training for educators, clear ethical guidelines, and enhanced support for AI integration is crucial for fostering effective and responsible AI use in education. Both desk and field research emphasise the necessity of preparing educators and students to navigate the ethical and practical dimensions of AI adoption. Equipping educators with the skills to evaluate, select, and implement AI tools effectively, while fostering critical thinking skills in students, are essential steps. This will allow them to assess information generated by AI and promote responsible AI use. Additionally, addressing concerns around data privacy and algorithmic bias through clear protocols and training is essential. By carefully considering these implications and developing a comprehensive strategy that includes user-friendly AI tools, national AI strategies, and institutional policies, HE institutions can leverage the power of AI to enhance student learning, prepare graduates for the future workforce, and promote responsible innovation in the digital age.

4.4 Recommendations for Future Research and Policy

Drawing from insights gathered in both desk research and the needs analysis survey, future efforts in AI integration for education should prioritise two interconnected goals: establishing comprehensive ethical frameworks and fostering collaborative AI development that empowers educators. These frameworks should address not only potential biases in algorithms but also the long-term impact of AI on learners, including the cultivation of critical thinking and lifelong learning skills. Collaborative efforts between educators and technologists can ensure AI solutions are tailored to address specific educational needs, promote knowledge sharing across institutions, and encourage the co-creation of innovative learning experiences. Additionally, expanding access to high-quality AI training and resources for both educators and students remains essential. By building digital fluency and fostering responsible AI use, we can empower all stakeholders to leverage AI's full potential. This goes beyond enhancing

teaching, learning, and administrative efficiency. It unlocks opportunities for promoting lifelong learning journeys, fostering collaborative innovation in the digital age, and equipping learners with the critical skills needed to thrive in an AI-driven future.

To realise this vision, policymakers must play a pivotal role. Developing clear and comprehensive policies that support AI integration in education is essential. These policies should establish ethical guidelines, data privacy regulations, and accountability frameworks. Investing in teacher training and professional development programmes focused on AI literacy and pedagogy is also crucial. Furthermore, policymakers should encourage collaboration between educational institutions, technology providers, and researchers to foster innovation and knowledge sharing. Notably, as also highlighted by the field research participants, given the potential for malicious use of AI, governments must also prioritise cybersecurity, developing robust measures to protect against cyberattacks, misinformation, and other threats. By creating a supportive policy environment, governments can accelerate the responsible and effective integration of AI in education, ultimately benefiting learners, educators, and society as a whole.

5. Conclusion

In conclusion, this transnational study leveraged comprehensive desk research and field surveys in Cyprus, the Netherlands, Greece, Ireland and Belgium to illuminate a multifaceted picture of AI integration in HE. Nowadays, AI tools are transforming both professional and pedagogical practices. In professional settings, AI streamlines administrative tasks like scheduling, resource allocation, and document management. AI-powered data analytics empower data-driven decision-making for strategic planning and curriculum development. Additionally, AI assists with research tasks such as literature reviews, data analysis, and content creation. When it comes to pedagogy, AI personalises learning experiences by

tailoring content and instruction to individual student needs. AI-powered tools facilitate assessment and feedback, create engaging educational materials, and foster student support through virtual tutors and chatbots. These tools enhance student engagement and interaction, while also promoting accessibility and inclusivity.

However, the study also underscores the complexities associated with responsible AI integration in HE. Ethical concerns regarding data privacy, algorithmic bias, and potential misuse necessitate careful consideration. Educators grapple with the rapid pace of AI development, requiring training and capacity-building opportunities to effectively leverage these tools within existing curricula. Furthermore, ensuring equitable access and mitigating potential biases within AI algorithms require close collaboration between educators, policymakers, and AI developers. Beyond ethical considerations and training limitations, educators expressed concerns about the effectiveness and reliability of AI tools themselves. The accuracy of AI-generated information was a recurring issue, underlining the importance of fact-checking to avoid misleading students. Additionally, concerns were raised regarding the lack of specificity in AI responses and the potential for unreliable source findings in research tasks. Alongside the development of reliable and easily accessible resources with tools and good practices, this will facilitate the efforts of staff and students to keep up with the evolving landscape of AI technologies. Also, providing guidelines and training opportunities for HE students on how to make the best and most responsible use of AI tools for their learning, including effective fact-checking and critical evaluation of sources, is crucial.

The challenges of adapting teaching practices to effectively integrate AI were also highlighted. Ensuring alignment between AI tools and existing curricula was a major concern, along with the need for practical guidance on implementing AI in the

classroom for different age groups and support on developing and customising AI tools. Furthermore, efforts should be made to create a common understanding of the use of AI in HE to make collaboration among HE staff in using AI tools possible. The potential impact on student development was another concern, with some educators worried that overreliance on AI could hinder critical thinking skills. Finally, educators in some countries called for the development of clear policies around AI use in education to ensure responsible integration.

These findings underscore the need for a multifaceted approach to AI integration in HE. Addressing ethical concerns, providing adequate training and support for educators, and developing user-friendly, reliable AI tools are all crucial steps. Furthermore, fostering collaboration between educators, curriculum developers, and AI specialists is essential to creating a framework for successful AI integration that enhances educational experiences for all stakeholders.

Finally, acknowledging limitations encountered during the literature review and survey processes is important. These include potential contextual specificity and survey response biases. Addressing these limitations through ongoing research and refinement will pave the way for a more comprehensive understanding of AI integration in HE. By effectively harnessing AI's potential while navigating its complexities, we can shape a more innovative and equitable educational landscape for the future.

In conclusion, the INFINITE project has great potential to empower the HE community concerning the above-mentioned needs through the development of the AI Literacy Toolkit, AI Digital Hub and capacity-building courses for HE academics and students. The Action Plan for HEIs will also serve as an important input towards a common understanding and collaboration across the HE institutions.

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