
GENERATIVE AI IN UNIVERSITY EDUCATION

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University of Southern Denmark

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1. Topic Introduction and Motivation

1.1. Background

In the ever-evolving landscape of higher education, the integration of Generative Artificial Intelligence (AI) stands at a pivotal junction, promising to redefine the contours of Advanced Digital Skills (ADS) curriculum development and learning support systems. This transformation is not just a mere technological upgrade but a fundamental shift in how knowledge is imparted, experienced, and applied in university settings. The workshop, "Generative AI in University Education," part of the LEADS project, was conceived against this backdrop of rapid technological advancement and burgeoning demand for advanced digital skills.

The motivation for this workshop is rooted in the recognition of AI's exponential growth and its far-reaching implications for ADS education. AI's ability to access, analyse, and synthesise vast amounts of information surpasses human capacities, possibly presenting a game-changing opportunity in curriculum development. By harnessing AI, educators might navigate through a dynamic ecosystem of resources, ensuring curricula remain current, relevant, and reflective of the latest trends and developments in their fields.

Beyond curriculum design, AI's potential in personalising the educational journey of students is immense. It promises a new era of learning experiences, where education is not just about information dissemination but about fostering a collaborative, interactive, and engaging learning environment. The workshop aimed to explore these opportunities while also addressing the challenges and ethical considerations inherent in integrating AI into education. The critical question it sought to answer was: How can Generative AI revolutionise ADS Curriculum Development and Learning Support Systems to propel education into a new era?

This workshop's focus aligns with the broader objective of meeting the digital decade targets, especially in training 20 million ICT specialists by 2030 and enhancing gender balance in the ICT workforce. It reflects a commitment to not only keeping pace with technological advancements but also shaping them to enrich educational experiences and outcomes. The discussions and insights from this workshop are intended to contribute to a set of recommendations for the European Commission and educational institutions, guiding the responsible and innovative use of AI in university education.

1.2. Workshop Summary

The "Generative AI in University Education" workshop, an integral component of the LEADS project, was a seminal event that brought together a diverse group of experts to discuss the intersection of AI and education. Held online in mid-January, this workshop was a melting pot of ideas, experiences, and visionary insights, all converging on the topic of Generative AI's transformative potential in ADS (Advanced Digital Skills) education.

The workshop commenced with an insightful introduction, representing the LEADS project, which laid the foundation with a presentation that underscored the urgent need for advanced digital skills to meet the targets of the digital decade. Hereby emphasising the goal of cultivating 20 million ICT specialists by 2030 and addressed the importance of gender balance in ICT.

The panel of speakers, including Marco Scirea, Luca Schirru, Luca Malinverno, and Andrea Maurino, provided a rich tapestry of perspectives on AI's application in education. Marco Scirea's discourse on the biases and limitations inherent in AI models shed light on the ethical dimensions of AI usage. Luca Schirru delved into the intricate copyright issues surrounding the use of copyrighted materials in training generative AI systems, a topic of critical relevance to both the creative and academic worlds.

Luca Malinverno's practical approach highlighted generative AI's role as an invaluable tool for educators in curriculum development and student engagement. Complementing these discussions, Andrea Maurino's survey presentation revealed insights on the utilisation of ChatGPT in educational settings, emphasising its benefits and potential risks.

The workshop facilitated a vibrant dialogue on the application of AI in curriculum development, focusing on optimising learning paths and addressing the emergence of prompt engineering courses. The discussions underscored the need for critical thinking and soft skills in leveraging AI effectively.

In summary, the workshop not only illuminated the current state of AI in education but also charted a path for its future integration, emphasising the need for a balanced approach that respects ethical considerations while harnessing AI's full potential.

2. Workshop Implementation

2.1. Workshop Structure

The "Generative AI in University Education" workshop was structured to facilitate in-depth discussions and maximise participant engagement, while addressing the complex intersections of AI and education. The workshop was divided into several key segments, ensuring a holistic exploration of the topic.

The event kicked off with an introductory session setting the context and objectives of the workshop, followed by a foundational presentation on the LEADS project, highlighting the pressing need for advanced digital skills and the digital decade targets.

The core of the workshop comprised a series of presentations from speakers within the AI community, including Marco Scirea, Luca Schirru, Luca Malinverno, and Andrea Maurino. Each speaker brought unique insights and expertise, ranging from the ethical implications of AI to its practical applications in education.

Key segments of the workshop included:

1. **Insightful Presentations from AI Experts:** Focused on various aspects of generative AI, including biases in AI models, copyright issues in AI training, and practical applications in education.
2. **Interactive and Collaborative Panel Discussions:** Facilitated a lively exchange of ideas among experts and attendees, fostering a deeper understanding of AI's role in curriculum development.
3. **Summary of Recommendations:** Summarised the recommendations reached from the presentations and collaborative panel discussion, between speakers and participants.

The workshop boasted a high attendance rate of 64, indicating a strong interest in the topic among academics and industry professionals. The interactive format and diverse range of topics ensured that the workshop was not only informative but also engaging, culminating in a rich exchange of ideas and perspectives.

Table 1 shows the agenda for the workshop:

Program – Generative AI in University Education: January 17th, 2024 - online	
10:00	Welcome and introduction (participants, LeADS and ADS)
10:05	Presentation of the outcome goals and purpose of the workshop
10:10	Presentations by the speakers
10:50	Panel discussion regarding questions with AI experts
11:50	Summary of visions and implementation suggestions
12:00	Wrap-up and closing

Table 1. Workshop agenda

2.2. Panel Speakers

The workshop on "Generative AI in University Education" featured a distinguished panel of speakers, each bringing a wealth of knowledge and experience in various aspects of AI and education. The following is an overview of the guest speakers at the workshop:

Marco Scirea, Associate Professor at Southern University of Denmark

Marco Scirea, Associate Professor, brought a rich academic perspective to the workshop. With a background in computer science and a focus on artificial intelligence, he has delved into the ethical implications and biases inherent in AI models. His research interests span a wide range, from AI in creative domains to its application in education. In the workshop, Marco emphasized:

- The importance of acknowledging and addressing biases in AI models.
- The ethical considerations necessary when implementing AI in educational contexts.
- The role of AI in shaping curriculum development and enhancing the learning experience.

Luca Schirru, Researcher at CiTiP KU Leuven

Luca Schirru, a researcher specializing in IT and intellectual property law, added a legal dimension to the discussion. His insights into the copyright challenges of using AI in education were particularly enlightening. Luca highlighted:

- The complex legal landscape surrounding the use of copyrighted works in AI training.
- The need for a balanced approach to intellectual property rights in the age of AI.
- The implications of AI advancements on traditional educational materials and methods.

Luca Malinverno, Data Scientist at Porini

Luca Malinverno, with his extensive experience as a data scientist, discussed the practical applications of AI in educational settings. His presentation focused on how AI can assist educators and students alike. Key points from Luca included:

- The role of AI as a tool for educators in creating tests, documents, and multimedia content.
- Ethical considerations and the responsibility of educators in utilizing AI-generated content.
- Real-world applications and case studies demonstrating the impact of AI in education.

Andrea Maurino, Professor at University of Milano-Bicocca

Andrea Maurino, a Professor at the University of Milano-Bicocca, provided valuable insights into the real-world usage of AI tools like ChatGPT in educational settings. His presentation was based on a comprehensive survey conducted among students and faculty, revealing:

- The positive aspects and potential risks associated with the use of AI tools in education.
- The impact of AI on traditional teaching methodologies and student learning paths.
- The need for an 'honour code' in education to govern the ethical use of AI.

The panel collectively contributed to a multifaceted understanding of the role of generative AI in university education. Their discussions illuminated the ethical, legal, practical, and pedagogical aspects of AI in education, providing a comprehensive overview of the challenges and opportunities presented by this transformative technology. The insights shared by the speakers were instrumental in shaping the workshop's outcomes and recommendations, paving the way for future initiatives in the integration of AI into higher education.

3. Panel Discussion and Recommendations

The panel discussion at the "Generative AI in University Education" workshop focused on exploring the multifaceted role of AI in higher education. The panellists, each an expert in their respective fields, engaged in a thought-provoking discussion centred around four key questions, crucial to understanding and leveraging the potential of Generative AI in the educational sector. These questions were:

- How can Generative AI aid curriculum development?
- Can Generative AI solutions be tailored for advanced digital skills education?
- How might AI help students/trainees optimise their advanced digital skills learning paths?
- Do we expect the emergence of curricula and courses focused on prompt engineering, and if so, to which extent?

3.1. How can Generative AI aid curriculum development?

The workshop participants discussed the role of Generative AI in curriculum development, focusing on how it can enhance and streamline educational processes. Key points and recommendations from the discussion included:

Enhancing Curriculum Design: The discussion was initiated by exploring how Generative AI could aid curriculum development. The potential for AI to assist in drafting slides for teaching and structuring curricula was pointed out, in addition to AI's ability to structure content efficiently which can significantly reduce preparation time for educators.

Assisting in Educational Content Creation: It was elaborated that the practical applications of Generative AI in education, mentioning that AI could act as a high-level teaching assistant, enhancing the quality and accessibility of educational materials.

Reviewing and Translating Educational Materials: AI's utility in reviewing and translating documents, which could be particularly beneficial for non-native speakers, was highlighted. This aspect of Generative AI can help clean up and prepare documents more efficiently, making them more accessible and understandable for a broader audience.

Facilitating Test Creation and Fairness: One of the more specific uses of Generative AI discussed, was in the creation of tests and exams. Generative AI can help educators create multiple versions of exams to ensure fairness and prevent copying, thereby addressing a significant challenge in the evaluation process.

AI as a Copilot in Education: AI was described as a potential 'copilot' for educators, assisting in creating various educational materials like tests, documents, and lessons. This analogy captures the supportive role AI can play, augmenting the capabilities of educators without replacing them.

Overall, the discussion underscored the potential of Generative AI to revolutionize curriculum development by making it more efficient, adaptable, and accessible. The participants emphasized the need for educators to guide and oversee AI's application to ensure the quality and relevance of the educational content.

3.2. Can Generative AI solutions be tailored for advanced digital skills education?

The workshop participants discussed the potential of tailoring Generative AI solutions for advanced digital skills (ADS) education, highlighting the adaptability of AI in various educational contexts. Key points and recommendations from the discussion included:

Tailorability of AI Solutions: The participants acknowledged that Generative AI could indeed be tailored in numerous ways to suit the specific needs of ADS education. This adaptability is key to its integration into various educational aspects, from curriculum design to learning methodologies.

Challenges in Customization: Despite this potential, challenges in customization was noted. Creating AI models based on individual requirements can be complex due to data limitations. There may not be enough relevant data to train these models specifically for ADS education. The discussion also touched on the technical demands of customising AI for education, including the need for advanced hardware to process the information. This requirement underscores the resource-intensive nature of tailoring AI solutions.

Meta Prompting in Large Models: It was pointed out that existing large AI models could currently be adapted for ADS education through meta-prompting. This technique allows for the customisation of AI responses based on specific educational needs, offering a practical approach to integrating AI into ADS education.

In conclusion, while there are evident opportunities to tailor Generative AI for ADS education, the process is not without its challenges. These include the need for substantial data, appropriate hardware, and strategies to overcome the limitations of existing AI models.

3.3. How might AI help students/trainees optimise their advanced digital skills learning paths?

In the workshop, the question of how AI might help students or trainees optimise their advanced digital skills learning paths was addressed. Key points and recommendations from the discussion included:

Need for Research and Best Practices: It was emphasised that since Generative AI is a relatively new field, there is a lack of extensive research and established best practices. This gap in knowledge and experience presents a challenge in fully understanding and utilising AI's potential in

optimising learning paths. A challenge that can be overcome in the future, if more resources are allocated to extensive research on the area, in addition to lecturers being offered educational training in how to utilise AI as an educational tool.

Ethical Considerations and Student Responsibility: The discussion also touched on the importance of ethics in using AI for educational purposes, pointing out the need for students to be aware of their responsibility for the results obtained from AI tools, indicating a need for ethical guidelines and responsible usage.

AI's Role in Supporting Different Learning Styles: An ongoing study was mentioned on how Generative AI can support various learning styles. This suggests that AI has the potential to adapt teaching methods to suit individual student needs, thereby enhancing the learning experience.

In summary, while AI holds significant promise for enhancing the learning journey in advanced digital skills, the workshop underscored the need for more research, development of best practices, and a strong focus on ethical use to fully realise its potential.

3.4. Do we expect the emergence of curricula and courses focused on prompt engineering, and if so, to which extent?

The emergence of curricula and courses focused on prompt engineering was a topic of discussion during the workshop. The participants considered the extent to which this specialised area could be integrated into higher education programs. The conversation revealed a growing interest in the field and the potential for its incorporation into existing curricula. Key points and recommendations from the discussion included:

Incorporation into Existing Programs: The workshop indicated that there is already movement towards integrating prompt engineering into university curricula. For instance, at the University of Denmark, efforts are being made to implement lectures for new students on how to interact with advanced AI systems like ChatGPT. This suggests a recognition of the relevance of prompt engineering in the current digital landscape and its potential value to students.

Impact on Different Levels of Education: It was noted that the impact of such courses might vary depending on the level of education. For bachelor's degree programs, incorporating prompt engineering could have a significant impact due to the standardised nature of the knowledge at this level. However, for advanced degrees like master's programs, where content is more novel and specialised, the impact of prompt engineering could be less pronounced.

In summary, the workshop highlighted a growing awareness and interest in prompt engineering as a vital component of digital education. Universities are beginning to explore ways to integrate this

emerging field into their programs, reflecting the evolving needs of the digital world and the importance of equipping students with cutting-edge skills in AI and machine learning.



4. Recommendation Use Cases

The following use cases are imagined examples of how the outcome of the panel discussion can be put into practical use.

4.1. Enhancing Curriculum Design

Use Case: Automated Curriculum Structuring for a New Course on Environmental Science.

The environmental science department intends to launch a new course focusing on Climate Change Mitigation Strategies. The lecturer uses Generative AI to outline the curriculum efficiently. By inputting the course goals and desired learning outcomes, the AI suggests a module structure for the course, including key topics and suggested reading materials. This process, which can traditionally take weeks, is significantly streamlined, allowing for a well-structured curriculum to be developed in a matter of days.

Use case description

Use case name	Generalized Automated Curriculum Structuring for New Courses
Context	Applicable across various academic departments looking to develop new courses.
Purpose and Expected Outcomes	To generalize the application of Generative AI in curriculum design, enabling efficient and effective course development that aligns with educational goals and outcomes across disciplines.
Overview	This use case involves the application of Generative AI across different academic departments to assist in the creation of new courses. By inputting specific course goals and desired outcomes, the AI generates a structured curriculum proposal. This includes suggested module outlines, key topics, and reading materials, streamlining the curriculum design process from weeks to a matter of days.
Lead user	Academic staff involved in curriculum development across departments.
Users and stakeholders	Students, faculty members, curriculum developers, academic department heads, educational content providers, accreditation bodies.
Current processes	Manual, discipline-specific curriculum development processes that are time-intensive and rely heavily on the individual expertise of academic staff.
Changed processes	Utilizing Generative AI to automate and standardize the process of curriculum structuring, making it more efficient and less reliant on individual workload and expertise.

Current maturity (TRL)	TRL 4-6, indicating that while the technology is in development or piloting phases, it is not yet fully integrated into educational systems at scale.
Barriers to adoption	Challenges include ensuring the AI's content relevance across disciplines, overcoming resistance from educational staff, integrating AI tools into existing systems, and training users.
Impact/Effort score	7/10 Impact: High potential for broad application and efficiency gains. Effort: High, due to the need for cross-disciplinary implementation and training.
Comments	While the promise of AI in automating curriculum design is vast, its success and impact are contingent upon overcoming significant adoption barriers, ensuring cross-disciplinary relevance, and addressing concerns about the quality of AI-generated content.

Instance of the use case

Use case name	Automated Curriculum Structuring for a New Course on Climate Change Mitigation
Context	In the environmental science department, a new course focusing on Climate Change Mitigation Strategies is being developed.
Purpose and Expected Outcomes	To streamline the curriculum design process, enabling the lecturer to develop a well-structured curriculum that aligns with the course goals and desired learning outcomes efficiently.
Overview	Utilizing Generative AI, the lecturer inputs the course goals and desired learning outcomes to receive a structured curriculum proposal. This includes module structures, key topics, and suggested reading materials. The AI's suggestions aim to condense the weeks-long process of curriculum development into just a few days, enhancing the efficiency and effectiveness of course design.
Lead user	Lecturer in the Environmental Science Department
Users and stakeholders	Students of the course, other faculty members involved in curriculum design, department heads, educational content providers
Current processes	Manual curriculum development involving extensive research and organization by the lecturer, typically requiring weeks to complete.
Changed processes	Implementation of Generative AI to automate the structuring of the curriculum based on inputted course goals and outcomes, significantly reducing the development time.

Current maturity (TRL)	TRL 4-6 (depending on the advancement and integration level of Generative AI in the educational sector)
Barriers to adoption	Reluctance from faculty to rely on AI for curriculum development, potential inaccuracies in AI-generated content, need for AI training among lecturers.
Impact/Effort score	8/10 Impact: High potential to significantly enhance curriculum design efficiency. Effort: Moderate, requiring AI integration and user training.
Comments	The use of Generative AI in curriculum development offers a promising avenue to enhance educational quality and efficiency, though its success hinges on overcoming adoption barriers and ensuring accuracy and relevance in the AI-generated suggestions.

- a. Risk: Moderate, with considerations on the accuracy and relevance of AI-generated curriculum components.
- b. Effort: Moderate to High, due to the need for comprehensive integration of AI tools and ongoing curriculum validation.
- c. Relevance: Very High, as it addresses the urgent need for updated and efficient curriculum development in rapidly evolving fields like environmental science.

4.2. Assisting in Educational Content Creation

Use Case: Development of Interactive Learning Materials for Online Education.

An educator is tasked with converting an existing in-person course on SQL databases to online Kahoot-quiz format. The educator feeds a series of slides to the AI, to inform it of the course content and ask it to invent 10 questions, each with a single correct answer, and three false answers. The output from the AI is quickly reviewed and copy-pasted into the Kahoot-quiz format, ready to be published on the course website, to allow students and others to test their knowledge on SQL databases.

Use case description

Use case name	Automated Creation of Interactive Learning Materials Across Disciplines
Context	Broad application in transitioning in-person courses across various disciplines to interactive online formats.

Purpose and Expected Outcomes	To standardize and expedite the development of interactive online learning materials, using AI to create diverse and engaging content that enhances learning outcomes and engagement in virtual environments.
Overview	This generalized use case involves employing AI across educational sectors to facilitate the creation of online learning materials, such as quizzes, interactive modules, and assessments. Educators provide AI with course content, from which it generates questions and materials tailored to the online learning environment. The process aims to reduce the time and effort required to create engaging content, fostering more dynamic and interactive online learning experiences.
Lead user	Educators and content developers across academic departments.
Users and stakeholders	Students, online education platforms, educational technology specialists, curriculum designers, department heads.
Current processes	Traditional, manual development of online learning materials, often resulting in a time-consuming process that can limit the diversity and interactivity of educational content.
Changed processes	Utilization of AI to automate and enhance the creation process, producing a variety of high-quality, interactive learning materials with reduced effort and time investment.
Current maturity (TRL)	TRL 4-6, indicating ongoing development and initial implementations but not widespread adoption in the creation of interactive educational content.
Barriers to adoption	Challenges include ensuring the educational quality of AI-generated materials, achieving seamless integration with various online platforms, and addressing skepticism from educators and students.
Impact/Effort score	8/10 Impact: Potential for significant improvements in the quality and accessibility of online educational content. Effort: Moderate, requiring adaptation to and familiarity with AI tools, plus oversight to maintain content quality.
Comments	The scalability of AI in generating educational content offers a promising avenue for enriching online education, though its success is contingent on overcoming technical, acceptance, and quality assurance hurdles.

Instance of the use case

Use case name	Development of Interactive Learning Materials for Online SQL Database Course
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Context	Transition of an in-person SQL database course to an online format, specifically using Kahoot for quizzes.
Purpose and Expected Outcomes	To utilize AI for the creation of engaging and educational quiz content that enhances online learning experiences, facilitating the testing of students' knowledge on SQL databases in an interactive manner.
Overview	An educator, transitioning an in-person course to online, employs AI to generate quiz questions for a Kahoot-based assessment. By inputting the course's slide content into the AI, the educator requests the generation of 10 specific questions, each with one correct and three incorrect answers. The AI's output is efficiently integrated into the Kahoot quiz format, streamlining the content creation process and enriching the online learning environment.
Lead user	Educator/Instructor of the SQL database course
Users and stakeholders	Students of the course, educational content developers, online education platforms (e.g., Kahoot), other faculty considering online education tools
Current processes	Manually crafting quiz questions based on course content, a time-consuming process that involves significant effort from the educator.
Changed processes	Leveraging AI to automatically generate quiz questions based on the course material provided, significantly reducing preparation time and effort.
Current maturity (TRL)	TRL 4-6, suggesting the technology is in the development to piloting phase but not yet widely adopted for educational content creation.
Use case name	Development of Interactive Learning Materials for Online SQL Database Course
Context	Transition of an in-person SQL database course to an online format, specifically using Kahoot for quizzes.
Purpose and Expected Outcomes	To utilize AI for the creation of engaging and educational quiz content that enhances online learning experiences, facilitating the testing of students' knowledge on SQL databases in an interactive manner.

- a. Risk: Low, with the primary concern being the fidelity and educational value of AI-generated quiz questions.
- b. Effort: Moderate, reflecting the initial setup and ongoing management of AI-generated content integration into educational platforms.
- c. Relevance: High, due to the increasing demand for interactive and flexible online learning solutions.

4.3. Reviewing and Translating Educational Materials

Use Case: Making Advanced Physics Accessible to Non-Native English Speakers.

A university physics department recognizes the need to make their advanced courses more accessible to international students, many of whom are non-native English speakers. Generative AI is employed to review and translate the course materials into multiple languages. Additionally, it can be asked to simplify complex scientific language into more understandable terms, to avoid losing context accuracy, while making the materials more accessible for outside readers. This not only broadens the course's accessibility but also enhances comprehension and learning outcomes for a diverse student body.

Use case description

Use case name	Enhancing Educational Accessibility for Non-Native Speakers Across Disciplines
Context	General application in universities aiming to make various advanced courses accessible to international students, especially non-native English speakers.
Purpose and Expected Outcomes	To generalize the use of Generative AI in translating and simplifying academic content across disciplines, improving accessibility, comprehension, and learning outcomes for a global student body.
Overview	This broader use case envisions the application of Generative AI across multiple academic departments, facilitating the translation and contextual simplification of advanced course materials. By making educational content more accessible and understandable to non-native English speakers, universities can enhance the inclusivity and effectiveness of their programs, benefiting a diverse array of international students.
Lead user	Academic departments, faculty, and administrative staff across universities
Users and stakeholders	International students, educators, curriculum developers, translators, academic advisors, and global education advocates
Current processes	Advanced academic content is predominantly available in English, with complex terminology that can hinder comprehension among non-native speakers.
Changed processes	Implementing Generative AI to systematically translate and simplify academic materials, ensuring broader accessibility and comprehension across various disciplines.

Current maturity (TRL)	TRL 4-6, indicating that while the technology is being piloted, widespread adoption across disciplines remains in progress.
Barriers to adoption	Challenges include ensuring the precision of AI translations, maintaining the accuracy of simplified content, integrating AI tools with existing educational platforms, and securing buy-in from faculty.
Impact/Effort score	7/10 Impact: High potential to enhance global accessibility and educational equity. Effort: High, due to the need for comprehensive implementation and continuous content validation.
Comments	Expanding the use of AI for content translation and simplification across disciplines offers a path toward more inclusive and effective education for international students, promoting diversity and global understanding within academic communities.

Instance of the use case

Use case name	Making Advanced Physics Accessible to Non-Native English Speakers
Context	A university physics department aiming to make advanced courses more accessible to international students, particularly non-native English speakers.
Purpose and Expected Outcomes	To employ Generative AI for translating and simplifying course materials without losing context accuracy, thereby enhancing accessibility, comprehension, and learning outcomes for a diverse student body.
Overview	Recognizing the diversity of its student body, the physics department utilizes Generative AI to make advanced physics courses more inclusive. The AI reviews course materials, translating them into multiple languages and simplifying complex scientific terminology. This approach maintains the accuracy of the content while making it more understandable for non-native speakers, thus broadening accessibility and improving educational outcomes.
Lead user	Physics Department Faculty and Staff
Users and stakeholders	International students, educators, translators, educational content developers, other university departments
Current processes	Course materials are primarily in English, with complex scientific language that can be a barrier to understanding for non-native speakers.

Changed processes	Using Generative AI to automatically translate and simplify content, making the learning process more inclusive and accessible.
Current maturity (TRL)	TRL 4-6, as the technology for accurate translation and contextual simplification is developed but not widely implemented in educational settings.
Barriers to adoption	Potential inaccuracies in translation or simplification, the need for subject matter experts to review AI-generated content, and resistance to adopting new technologies.
Impact/Effort score	8/10 Impact: Significantly increases accessibility and comprehension for non-native English speakers. Effort: Moderate, requiring initial setup, ongoing review, and adjustments to ensure content quality.
Comments	This initiative represents a significant step towards inclusivity in education, leveraging AI to accommodate the needs of a diverse student population while maintaining the integrity of scientific content.

- a. Risk: Moderate, with accuracy in translation and simplification as the primary concern to ensure the integrity of educational content.
- b. Effort: High, reflecting the comprehensive effort needed for technology integration, content review, and ongoing adjustments.
- c. Relevance: Very high, addressing the critical need for inclusivity and accessibility in global education environments.

4.4. Facilitating Test Creation and Fairness

Use Case: Generating Multiple Versions of a Statistics Exam.

In a large introductory statistics course, the professor is concerned about maintaining test integrity and fairness. To address this, Generative AI is fed a series of example questions, a series of datasets, and is asked to plot these into a variety of scenarios, to produce a series of questions of equivalent difficulty. The professor can then go through the questions, to ensure that students are evaluated on the same concepts, while the main workload involved was carried out by AI. The

variation in the exams thus minimizes the chances of copying and promotes a fair assessment of each student's understanding.

Use case description

Use case name	Enhancing Exam Integrity and Fairness Across Disciplines with AI
Context	Application across various large introductory courses to address concerns of exam integrity and fairness through content variation.
Purpose and Expected Outcomes	To broadly implement Generative AI for generating multiple versions of exams across disciplines, ensuring fairness in student assessment and minimizing academic dishonesty.
Overview	Across multiple academic disciplines, instructors leverage Generative AI to create diverse versions of exams, each maintaining equivalent difficulty. By feeding the AI example questions and datasets relevant to their fields, instructors can generate varied exams that assess students on the same concepts through different scenarios. This approach significantly reduces the potential for copying, promoting fairness and maintaining the integrity of the assessment process at scale.
Lead user	Instructors and exam coordinators across academic departments
Users and stakeholders	Students, academic integrity committees, educational technologists, department heads
Current processes	Traditional exam creation methods that may not efficiently address the challenges of test integrity and fairness in large courses.
Changed processes	Adoption of Generative AI to systematically produce multiple, equivalent exams for diverse courses, facilitating fair and integrity-bound assessments.
Current maturity (TRL)	TRL 4-6, as the adaptation of AI for diverse academic exam creation is emerging but not yet widespread.
Barriers to adoption	Uniformity in difficulty across AI-generated exams, integration with current educational practices, resistance from educators, and ensuring the validity of AI outputs.
Impact/Effort score	8/10 Impact: Potential for a significant positive shift in academic assessment practices. Effort: High, necessitating cross-disciplinary AI implementation and continuous quality checks.

Comments	The potential of Generative AI to revolutionize educational assessments by enhancing fairness and integrity is vast, though its realization will require overcoming technical, cultural, and operational challenges.
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Instance of the use case

Use case name	Generating Multiple Versions of a Statistics Exam
Context	In a large introductory statistics course, addressing concerns of test integrity and fairness by varying exam content.
Purpose and Expected Outcomes	To use Generative AI for creating multiple versions of an exam, each with equivalent difficulty, thereby minimizing copying and ensuring a fair assessment of student understanding.
Overview	To maintain the integrity and fairness of exams in a large statistics course, a professor employs Generative AI to generate varied exam questions based on provided examples and datasets. The AI is tasked with plotting these datasets into different scenarios, creating questions of equal difficulty but different content. This approach allows for individualized assessments, with the bulk of the question generation workload managed by AI, while the professor ensures consistency in evaluation criteria.
Lead user	Statistics Course Professor
Users and stakeholders	Students taking the course, teaching assistants, academic integrity officers, exam coordinators
Current processes	Manual creation of a single version of the exam, posing risks of unfair advantage through copying or prior exposure to questions.
Changed processes	Utilizing Generative AI to automate the creation of multiple exam versions, each testing the same concepts but through different questions and data scenarios.
Current maturity (TRL)	TRL 4-6, indicating that the technology is in development and early implementation stages for educational assessment purposes.
Barriers to adoption	Ensuring the AI-generated questions maintain consistent difficulty and accuracy, integrating AI tools with the existing exam design processes, and obtaining buy-in from academic staff.
Impact/Effort score	9/10 Impact: Significantly improves test integrity and fairness. Effort: Moderate, given the need for oversight in question validation and AI adjustment.

Comments	This use case demonstrates the potential of AI to enhance educational assessment by producing diverse yet equitable exam content, thus upholding the principles of academic integrity and fairness in evaluation.
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- a. Risk: Moderate, with the primary concern being the consistent quality and difficulty of AI-generated exam questions.
- b. Effort: High, due to the necessity of closely monitoring AI outputs, validating question equivalence, and integrating the technology with existing assessment frameworks.
- c. Relevance: Very high, addressing crucial needs for fairness and integrity in academic evaluations in a rapidly digitizing educational environment.

4.5. AI as a Copilot in Education

Use Case: Collaborative Lesson Planning in a Robotics course on Internet of Things.

A Robotics professor wants to switch out the previously used microcontroller type in an Internet of Things course, with a different type. The AI is fed the data from the current introduction lecture on the old microcontroller and is asked to rewrite to fit the new microcontroller type and update the used practical examples as well. This process which could traditionally take a week, can now be undertaken in a single day.

Use case description

Use case name	AI-Enhanced Curriculum Adaptation Across STEM Fields
Context	Broad application in STEM fields for updating course content to include new technologies or methodologies.
Purpose and Expected Outcomes	To generalize the use of Generative AI for the quick adaptation of STEM curriculum, ensuring courses remain at the forefront of technological advancements and educational best practices.

Overview	Across various STEM disciplines, educators leverage Generative AI to promptly update course materials, including lectures and practical examples, to reflect new technologies or methodologies. This approach allows for rapid curriculum adaptation, reducing the update process from weeks to days, and ensures that students are learning with the most current information. The efficiency and effectiveness of this process significantly enhance the educational experience and the relevance of STEM education.
Lead user	Educators and curriculum developers across STEM departments
Users and stakeholders	Students, faculty members, academic administrators, educational technology developers
Current processes	Traditional, manual updates to course content that can lag behind technological advancements due to the time and effort required.
Changed processes	Adoption of Generative AI to automate and expedite the process of integrating new technologies into course content, maintaining curriculum relevance with minimal manual effort.
Current maturity (TRL)	TRL 4-6, as the application of AI for curriculum adaptation is emerging but not yet a standard practice across STEM fields.
Barriers to adoption	Challenges include maintaining the quality and accuracy of AI-generated content, the need for cross-disciplinary AI tool development, and overcoming institutional resistance to new approaches.
Impact/Effort score	8/10 Impact: Offers the potential for a significant upgrade in STEM education's responsiveness to technological changes. Effort: Moderate, requiring investment in AI tools and training for educators.
Comments	This higher-level view underscores the transformative potential of AI in keeping STEM education aligned with rapid technological advancements, fostering a more dynamic and relevant learning environment.

Instance of the use case

Use case name	Collaborative Lesson Planning for a Robotics Course on IoT
Context	A Robotics course focusing on Internet of Things (IoT), where the professor plans to update the curriculum to include a new type of microcontroller.

Purpose and Expected Outcomes	To employ Generative AI to quickly update the course's introduction lecture and practical examples to reflect the change in microcontroller type, enhancing the course relevance and student learning experience.
Overview	In adapting the Robotics course on IoT to incorporate a new microcontroller type, the professor uses Generative AI to revise the introductory lecture and practical examples. By inputting data about the old microcontroller and specifying the new type, the AI restructures the course content to align with the updated curriculum. This efficient process, reducing content update time from a week to a day, ensures that students receive the most current and applicable knowledge.
Lead user	Robotics Professor
Users and stakeholders	Students enrolled in the IoT course, teaching assistants, curriculum developers, other faculty members interested in course content adaptation
Current processes	Manual revision of course lectures and examples, a time-consuming task that involves extensive research and content restructuring.
Changed processes	Utilizing Generative AI for rapid content update, streamlining the adaptation of lectures and practical examples to new technological standards.
Current maturity (TRL)	TRL 4-6, indicating that the technology is in the development to early implementation stages within educational settings.
Barriers to adoption	Ensuring the accuracy and relevance of AI-generated content, integrating AI tools into existing course development workflows, and user resistance to new methodologies.
Impact/Effort score	9/10 Impact: Significantly enhances the course's responsiveness to technological advancements. Effort: Low, primarily involving oversight and fine-tuning of AI-generated updates.
Comments	This use case illustrates the potential of AI to facilitate agile curriculum development, enabling educators to swiftly incorporate new technologies and improve the educational experience.

- a. Risk: Low, with primary concerns centered around ensuring the quality and applicability of AI-generated content to real-world technologies.
- b. Effort: Moderate, due to the need for initial setup, ongoing AI model training, and content validation processes.

c. Relevance: High, reflecting the critical need for STEM curricula to rapidly adapt to technological innovations and industry standards.

4.6. Meta Prompting in Large Models

Use Case: Interactive AI Tutor for Machine Learning Concepts.

In a graduate-level machine learning course, the educators aim to integrate an AI tutor that can assist students with complex concepts and coding exercises. Using meta-prompting techniques, the AI model is fine-tuned to understand specific educational contexts and student inquiries. Students can interact with the AI tutor to get explanations of difficult topics, step-by-step guidance on machine learning algorithms, and personalized feedback on their code. The AI tutor adapts its responses based on the students' proficiency levels and learning styles, making advanced digital skills education more accessible and tailored to individual needs.

Use case description

Use case name	AI-Enhanced Personalized Learning Across Educational Contexts
Context	Application of AI tutors utilizing meta-prompting across various educational levels and subjects to provide personalized learning experiences.
Purpose and Expected Outcomes	To generalize the use of AI tutors, fine-tuned with meta-prompting techniques, to offer individualized guidance, explanations, and feedback across disciplines, enhancing educational accessibility and personalization.
Overview	Across multiple educational settings, AI tutors fine-tuned through meta-prompting are deployed to support students in mastering complex subjects by providing tailored explanations, procedural guidance, and feedback. By adapting to each student's learning style and proficiency level, these AI tutors aim to make education more accessible, engaging, and effective, bridging gaps in understanding and fostering a more inclusive learning environment.
Lead user	Educators and curriculum developers across various disciplines
Users and stakeholders	Students, educational technology specialists, academic institutions, parents and guardians, private and public educational sectors
Current processes	Conventional teaching methods that might not fully cater to individual learning differences, potentially leaving gaps in student understanding and engagement.

Changed processes	Implementing AI tutors to complement existing educational strategies, providing a more adaptive and responsive learning environment that meets diverse student needs.
Current maturity (TRL)	TRL 4-6, as the development and pilot testing of such AI tutors in educational settings are underway, but broader adoption and optimization are ongoing.
Barriers to adoption	Challenges include ensuring the pedagogical accuracy and responsiveness of AI tutors, integration with current educational infrastructures, data privacy and security, and overcoming resistance from educators and institutions.
Impact/Effort score	8/10 Impact: Has the potential to significantly enhance learning personalization and inclusivity. Effort: High, requiring substantial effort in AI development, training, and curriculum integration.
Comments	This broader application of AI in education underscores a shift towards more adaptive, personalized learning solutions, highlighting the critical role of technology in addressing diverse educational needs and improving learning outcomes.

Instance of the use case

Use case name	Interactive AI Tutor for Machine Learning Concepts
Context	A graduate-level machine learning course integrating an AI tutor to support students in understanding complex concepts and coding exercises.
Purpose and Expected Outcomes	To utilize meta-prompting in AI models for creating an interactive tutor that offers personalized explanations, guidance, and feedback in machine learning, tailored to the students' proficiency levels and learning styles.
Overview	In an effort to enhance learning outcomes in a graduate-level machine learning course, educators deploy an AI tutor fine-tuned through meta-prompting techniques to grasp educational contexts and student queries. This AI tutor engages with students to clarify challenging concepts, provide step-by-step instructions on algorithms, and give customized feedback on code. Its adaptability to various proficiency levels and learning preferences aims to make learning advanced digital skills more individualized and effective.
Lead user	Machine Learning Course Educators
Users and stakeholders	Students of the machine learning course, educational technology developers, curriculum designers, academic departments

Current processes	Traditional instructional methods relying on lectures, textbooks, and general feedback, which may not address all students' individual learning needs.
Changed processes	Introduction of an AI tutor capable of offering real-time, personalized academic support, thereby augmenting traditional teaching methods with interactive and tailored learning experiences.
Current maturity (TRL)	TRL 4-6, indicating that while the technology is being developed and tested, widespread implementation in educational settings is still in progress.
Barriers to adoption	Ensuring the AI tutor accurately understands and responds to diverse educational contexts and student needs, integrating it with existing learning management systems, and addressing privacy concerns.
Impact/Effort score	9/10 Impact: Substantially enriches student learning experiences by providing personalized educational support. Effort: Moderate, involving fine-tuning the AI model and integrating it into the course curriculum.
Comments	This use case demonstrates the potential of AI to revolutionize educational support by offering personalized assistance, thereby enhancing the effectiveness of digital skills education.

- a. Risk: Moderate, with considerations around ensuring the AI's pedagogical effectiveness and addressing data privacy.
- b. Effort: High, due to the complexities of developing, integrating, and maintaining advanced AI tutoring systems.
- c. Relevance: Very high, reflecting the growing demand for personalized learning experiences in digital education environments.

4.7. Ethical Considerations and Student Responsibility

Use Case: Developing an AI Ethics and Responsibility Module.

A technical university introduces a mandatory module on AI Ethics and Responsibility for all students enrolled in advanced digital skills courses. This module covers the principles of ethical AI use, data privacy, and the implications of AI on society. It includes interactive scenarios where students must navigate ethical dilemmas encountered while using AI in their projects. This educational approach aims to foster a sense of responsibility among students, ensuring they are not only proficient in using AI tools but also aware of the ethical considerations and societal impacts of their work.

Use case description

Use case name	Integrating AI Ethics Education Across Technical Disciplines
Context	Broad implementation of AI ethics and responsibility education in technical and digital skills programs across academic institutions.
Purpose and Expected Outcomes	To standardize the inclusion of ethical considerations and societal impacts in the curriculum of technical programs, ensuring that future professionals are not only technically adept but also ethically and socially conscious.
Overview	Academic institutions worldwide are recognizing the importance of integrating AI ethics and responsibility into technical education. This approach aims to prepare students across various disciplines for the ethical challenges they may face in their careers, emphasizing the importance of data privacy, ethical AI use, and understanding AI's broader societal implications. By including modules on AI ethics, complete with interactive scenarios and discussions, educational programs strive to produce well-rounded professionals who can contribute positively to society while advancing technological innovation.
Lead user	Academic institutions, educators, and curriculum developers in STEM and technical disciplines
Users and stakeholders	Students, educational policymakers, AI industry stakeholders, society at large
Current processes	A predominant focus on technical skill development in STEM education, with varying degrees of emphasis on ethical and social considerations.
Changed processes	Systematic incorporation of ethics modules into STEM curricula, enhancing the multidimensional education of students to include ethical reasoning and societal awareness.
Current maturity (TRL)	TRL 4-6, as efforts to embed ethics in technical education are growing, with emerging frameworks and pilot programs being tested.
Barriers to adoption	Challenges in integrating ethics into already dense curricula, ensuring engaging and relevant content, and aligning with industry and societal expectations.
Impact/Effort score	7/10 Impact: Essential for cultivating a generation of ethically minded professionals capable of navigating the complexities of modern technology. Effort: High, requiring interdisciplinary collaboration, curriculum innovation, and ongoing evaluation.

Comments	The movement towards incorporating AI ethics education reflects a growing consensus on the need for a holistic approach to technical training, emphasizing ethical competence as a core component of professional development in the digital age.
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Instance of the use case

Use case name	Developing an AI Ethics and Responsibility Module
Context	A mandatory module on AI Ethics and Responsibility introduced at a technical university for students enrolled in advanced digital skills courses.
Purpose and Expected Outcomes	To educate students on the ethical use of AI, data privacy, and AI's societal implications, fostering a sense of responsibility and ethical awareness in their professional conduct and AI applications.
Overview	The technical university integrates a comprehensive module on AI Ethics and Responsibility into its curriculum for advanced digital skills courses. This module addresses critical topics such as ethical AI use, data privacy, and the societal impacts of AI technologies. Through interactive scenarios, students engage with real-world ethical dilemmas they might encounter in their projects, encouraging them to consider the broader implications of their work with AI. This educational initiative aims to ensure that students are not only technically proficient but also ethically informed and responsible in their use of AI tools.
Lead user	Educators and curriculum developers in technical and digital skills programs
Users and stakeholders	Students, university administration, AI industry professionals, society at large
Current processes	Traditional digital skills education with a focus on technical proficiency, often lacking in comprehensive ethical education and awareness.
Changed processes	Introduction of a structured module focusing on AI ethics and responsibility, incorporating interactive and practical ethical dilemma scenarios to enhance student understanding and awareness.
Current maturity (TRL)	TRL 4-6, indicating that the conceptual framework for integrating ethics into technical education is developed, with pilot implementations underway.

Barriers to adoption	Potential resistance to curriculum changes, finding the balance between technical and ethical education, and ensuring relevance and engagement in the ethics module.
Impact/Effort score	8/10 Impact: High potential to cultivate ethically aware and socially responsible AI practitioners. Effort: Moderate, involving curriculum development, faculty training, and student engagement strategies.
Comments	This module represents a vital step in addressing the ethical and societal challenges of AI, equipping students with the knowledge and critical thinking skills needed to navigate these issues responsibly.

- a. Risk: Low, essential for future-proofing graduates against ethical challenges in technology.
- b. Effort: High, due to the need for developing engaging content and integrating it into established curricula.
- c. Relevance: Very high, aligns with global trends emphasizing ethical considerations in technology use.

4.8. Incorporation into Existing Programs

Use Case: Prompt Engineering Module in Software Engineering Degree.

A technical university decides to integrate a dedicated module on Prompt Engineering within its existing Software Engineering Bachelor's degree program. Recognizing the increasing importance of efficient interaction with AI systems in the software development process, the university designs this module to equip students with the skills needed to effectively communicate with and utilize AI tools, such as ChatGPT, for code generation, debugging, and documentation. The module includes hands-on workshops where students practise crafting prompts to solve real-world programming challenges, analyze the responses, and refine their techniques for better outcomes. By incorporating this module, the university aims to enhance the digital competence of their graduates, making them more adaptable to the evolving tech landscape where AI plays a significant role.

Use case description

Use case name	Enhancing AI Literacy in Engineering Education
Context	The broader integration of AI literacy modules, such as Prompt Engineering, into engineering and technical degree programs at universities worldwide.
Purpose and Expected Outcomes	To equip engineering students across disciplines with the skills to effectively utilize AI tools in their future careers, thereby enhancing their adaptability to the AI-enhanced tech landscape.

Overview	As AI technologies become integral to the tech industry, academic institutions globally are recognizing the need to embed AI literacy within their engineering and technical education programs. This involves the inclusion of specialized modules like Prompt Engineering, which teach students how to effectively interact with AI for various purposes, including coding, debugging, and documentation. Through practical exercises and real-world scenarios, these modules aim to prepare students for a future where AI tools are ubiquitous in the engineering process, ensuring they are not only proficient in their traditional disciplines but also skilled in leveraging AI technologies.
Lead user	Academic institutions, engineering and technical program directors
Users and stakeholders	Engineering students, educators, the tech industry, future employers, society at large
Current processes	Engineering and technical education with a primary focus on traditional disciplines, often lacking in comprehensive AI interaction training.
Changed processes	Systematic incorporation of AI literacy modules, like Prompt Engineering, across engineering and technical disciplines, providing a well-rounded education that includes AI skills.
Current maturity (TRL)	TRL 4-6, as initiatives to integrate AI literacy into technical education are emerging, with some institutions beginning to pilot such programs.
Barriers to adoption	Curriculum space limitations, the need for instructors skilled in AI technologies, aligning educational content with rapid technological advancements, and industry needs.
Impact/Effort score	7/10 Impact: Essential for preparing students for the future of work in tech. Effort: High, requiring significant curriculum development and resource allocation.
Comments	The shift towards incorporating AI literacy in engineering education marks a pivotal adaptation to the digital age, ensuring that graduates are equipped to meet the demands of an AI-integrated workforce effectively.

Instance of the use case

Use case name	Prompt Engineering Module in Software Engineering Degree
Context	Integration of a Prompt Engineering module within an existing Bachelor's degree program in Software Engineering at a technical university.

Purpose and Expected Outcomes	To provide students with the skills necessary to efficiently interact with AI systems in software development, including code generation, debugging, and documentation, through the use of ChatGPT and similar AI tools.
Overview	Recognizing the pivotal role of AI in software development, a technical university introduces a Prompt Engineering module into its Software Engineering degree. This module is designed to arm students with the expertise to effectively communicate with AI tools, enhancing their ability to leverage these technologies for coding tasks. It features hands-on workshops where students practice creating prompts to address programming challenges, enabling them to analyze AI responses and refine their interaction techniques for improved outcomes. This addition aims to bolster the digital proficiency of graduates, preparing them for a tech landscape increasingly dominated by AI.
Lead user	Software Engineering Department Faculty
Users and stakeholders	Software engineering students, academic curriculum developers, future employers, the broader tech industry
Current processes	Traditional software engineering education focusing primarily on manual coding techniques, with limited emphasis on AI interaction.
Changed processes	Introduction of a curriculum module dedicated to Prompt Engineering, incorporating practical AI interaction workshops to complement traditional coding education.
Current maturity (TRL)	TRL 4-6, indicating that the concept and implementation of such specialized modules are in developmental stages within academic settings.
Barriers to adoption	Curriculum integration challenges, ensuring faculty are equipped to teach prompt engineering concepts, and aligning module content with industry needs.
Impact/Effort score	8/10 Impact: High potential to significantly enhance graduates' adaptability and value in the AI-integrated tech landscape. Effort: Moderate, requiring curriculum development and faculty training.
Comments	This module represents an innovative step towards aligning software engineering education with the evolving demands of the tech industry, highlighting the importance of AI literacy in modern software development.

- a. Risk: Moderate, due to fast-paced AI advancements and curriculum adaptation needs.
- b. Effort: High, reflecting the necessity for continuous content updates and faculty training.
- c. Relevance: High, aligning with industry trends towards AI integration in software development.

5. Key Points and Recommendations Overview

The following tables outline universities' pivotal role in implementing the discussed solutions and serves as a framework to highlight how universities are central to addressing the challenges of integrating Generative AI into educational contexts. For an exemplification of how these can be implemented at the given institutions, see the presented use cases in section 4.

How can Generative AI aid curriculum development?	Policymaker	Industry	University
Generative AI can draft teaching slides and structure curricula, reducing preparation time for educators.			x
It can enhance educational material quality and accessibility by acting as a teaching assistant.			x
AI can efficiently review and translate documents, aiding non-native speakers.			x
Generative AI facilitates the creation of fair tests and exams by producing multiple versions.			x
AI serves as an educational 'copilot', supporting the creation of tests, documents, and lessons.			x

Can Generative AI solutions be tailored for advanced digital skills education?	Policymaker	Industry	University
Customising AI for education faces challenges like data limitations and the need for advanced hardware.			x
Meta-prompting allows large AI models to be adapted for specific educational needs in ADS.			x

How might AI help students/trainees optimise their advanced digital skills learning paths?	Policymaker	Industry	University
The lack of research and best practices in Generative AI presents a severe challenge. More research on the area is therefore recommended, before more concrete recommendations on best practices can be established.	x		x
Ethical considerations and student responsibility in AI use must be emphasised for responsible usage.	x		x

Do we expect the emergence of curricula and courses focused on prompt engineering, and if so, to which extent?	Policymaker	Industry	University
Universities, like the University of Denmark, are already integrating prompt engineering into curricula, recognizing its importance in the digital landscape.			x
The impact of prompt engineering courses varies by education level, being more significant in bachelor's programs than in advanced degrees.			x

5.1. Enhancing Systemic Impact Through Strategic AI Integration in Universities

The following two recommendations from the list above are highlighted here, since they address the systemic integration of Generative AI in educational settings, contrasting with other recommendations focused on individual or immediate applications. These recommendations are critical because they aim to implement foundational changes in educational policy and infrastructure, setting a broad framework for how institutions can leverage technology to reshape the future of education.

Recommendation 1: Enhance EU Investments in Generative AI Research for University Education

Investing in research on the optimal use of Generative AI within universities is crucial for increasing its educational benefits. This type of research is essential for understanding how AI can best be implemented as an educational tool, ensuring that it meets the specific needs of students and educators. By studying effective integration strategies, universities can leverage AI to offer on-demand, personalized learning experiences, allowing students to engage with material at their own pace and time. For lecturers, insights from this research can help streamline the preparation of teaching materials and assessments, boosting their efficiency and enabling them to focus more on student interaction and innovative teaching. Additionally, this research is vital for addressing ethical considerations and ensuring that AI applications are adaptable to diverse educational settings, ultimately enhancing the quality and accessibility of university education.

Recommendation 2: Develop and Integrate Prompt Engineering Courses into University Curricula

Prompt engineering is an emerging field crucial for optimizing interactions with Generative AI systems. By embedding prompt engineering courses into university curricula, particularly at the undergraduate level, educational institutions can prepare students more effectively for future demands in the advanced digital skills (ADS) sector. These courses should be designed to seamlessly integrate into existing programs, highlighting their importance in a practical and forward-looking educational strategy.

These recommendations are pivotal at a systemic level because they lay the groundwork for a more integrated, responsive, and technologically advanced educational infrastructure. They not only anticipate the future needs of the workforce but also ensure that educational institutions remain at the forefront of technological adoption and innovation.

6. Conclusion

The "Generative AI in University Education" workshop has served as a pivotal platform for exploring the transformative potential of AI in higher education, particularly in the realm of Advanced Digital Skills (ADS) education. With a diverse array of perspectives and insights from esteemed panellists like Marco Scirea, Luca Schirru, Luca Malinverno, and Andrea Maurino, the workshop provided a comprehensive understanding of the opportunities and challenges associated with integrating Generative AI into educational contexts, resulting in the following discussions and recommendations.

The workshop discussions illuminated the multifaceted ways in which Generative AI can aid curriculum development, from streamlining preparation tasks for educators to enhancing material quality and accessibility. Moreover, the recognition of Generative AI's role in facilitating fair assessment practices and serving as an educational 'copilot' underscores its potential to revolutionise teaching and learning experiences.

Furthermore, the workshop delved into the challenges and opportunities in tailoring Generative AI solutions for advanced digital skills education. While acknowledging obstacles such as data limitations and hardware requirements, the concept of meta-prompting emerged as a promising approach to adapt large AI models for specific educational needs in ADS.

Additionally, the workshop highlighted the importance of ethical considerations and student responsibility in AI usage, particularly in optimising learning paths for students. By emphasising ethical guidelines and promoting responsible usage, universities can ensure that AI-driven educational technologies contribute positively to student learning outcomes.

Lastly, the emergence of curricula and courses focused on prompt engineering signifies a recognition of the evolving digital landscape and the need to equip students with relevant skills. As universities like the University of Denmark integrate prompt engineering into their curricula, there is a growing acknowledgment of its significance in preparing students for the future workforce.

In conclusion, the workshop has not only shed light on the current state of AI in education but has also charted a roadmap for its future integration. By embracing a balanced approach that respects ethical considerations and harnesses AI's full potential, universities can lead the way in advancing ADS education and empowering students with the skills they need to thrive in the digital era. In addition a series of use case examples detail how these could potentially be applied in practice at a given institution.