

Perception and Integration of Generative AI in Today's Education

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Abstract. *Education has always been a cornerstone of human development and societal progress. Today, the rapid pace of technological innovation is reshaping how we teach, learn and assess knowledge. In this evolving landscape, Generative Artificial Intelligence (GenAI) is emerging as a transformative force with the potential to redefine the educational experience. That being said, it is mandatory to further explore the implications of GenAI in different economical landscapes such as education. This study examines the impact of this technology on education, exploring integration strategies and its effects on teaching, learning and assessment processes. The research integrates both a comprehensive literature review and a narrative approach to provide a solid theoretical foundation. It also includes an evaluation of the current technological market to identify frequently used innovative solutions. In addition, the study analyzes survey responses from participants directly involved in education to capture their perceptions, experiences and expectations regarding the integration of generative AI. Based on the findings, GenAI shows strong potential to transform education, but its success depends on responsible use, clear policies and proper training. This study shows that the future of education is not just about teaching with AI, it is about reimagining what it really means to learn, teach and evaluate in an AI-driven world.*

Keywords: Education, Generative AI, Emerging, Perspectives, Trends, Content Generation.

Technology has always been a key shaping factor on how society works. Through the years technology has improved a great variety of economical areas leading to industrialization and to fundamental changes on how things should be done at their core.

Almost every government issued initiative and economic movement talks about innovation. The only concern regarding innovation is that it always comes in the context of digitalisation and software development with a focus on Artificial Intelligence (AI). From agendas such as the one proposed by the United Nations regarding sustainable development (United Nations, 2015) to research papers focused on the improvement of AI (Vaswani et al., 2017), the pressure is always shifted to the Information Technology (IT) sector.

Transformers (Vaswani et al., 2017) made a great impression on the AI software development community leading to a fast-paced development of Large Language Models (LLMs), a piece of technology used in Generative Artificial Intelligence (GenAI).

Education is one of the domains that is prone to change, especially in the context of digitalisation, encountering difficulties and new challenges since the digitalisation forced by the COVID19 lockdown. This is why the development of digital competencies became a purpose for teachers (Fernández-Batanero et al., 2021) in order to enhance students' technical literacy. In the context of AI, especially GenAI, educational platforms can benefit significantly from the incorporation of such technologies in their architecture making it possible for learning activities to be tailored to the students' needs and learning styles (Eden et al., 2024).

The integration and adoption of AI systems in educational software became one of the most discussed topics both in education and IT sectors, especially because of the different opinions shared both by students and teachers. Depending on which aspect of the subject matter is discussed, students tend to have opinions that vary about the ethics and the proper usage of AI tools and one of the aspects that might lead to this variety of answers could be the lack of AI literacy courses in schools (Baksa et al., 2024). Among teachers, things seem to be strongly divided, especially when it comes to the development of critical thinking skills and following ethical guidelines while using AI.

These divergent opinions may be interpreted as a starting point that sustains the research of perceptions on how GenAI should be integrated into educational technologies if that is proven to be a good choice that enhances students' learning experiences. Thus, this study is both necessary and relevant to examine how learners and teachers perceive and use AI, to maximize its benefits, mitigate its risks and provide guidance for modern, future-ready education. The importance of examining both perception and actual use of Generative AI.

Literature review

GenAI is a broader terminology that covers a specific part of the AI sector, focusing on intelligent systems that can generate content (Sengar et al., 2025). The entities that generate content are called generating models that specialize in areas such as pattern recognition and structural understanding to create content in different forms: images, text, or other forms of media.

Core concepts and the current context of GenAI

One such entity that corresponds to the GenAI area is LLM. This piece of software tries to mimic the understanding of human language (also known as natural language) by implementing Natural Language Processing (NLP), making it possible for a model to generate content, usually in the form of a text response (Håkansson & Phillips-Wren, 2024).

LLMs spiked in popularity back in 2022 when ChatGPT was released to the public, but that would have not been possible without the development of the Transformer, innovation presented in 2017 by a team of researchers at Google (Vaswani et al., 2017). This innovation was crucial because by implementing this new architectural approach language models were able to process data sequentially. This made it easier to scale when the situation needed to, facilitating the proper usage of parallel processing on GPUs in the context of LLMs.

The most known LLMs are ChatGPT (GPT stands for Generative Pretrained Transformer), Gemini AI, Copilot and Claude. There are a variety of choices for LLMs, but ChatGPT and Gemini AI are usually known by the average user, while Copilot and Claude are mostly used in STEM (Science, Technology, Engineering, Mathematics) or other technical areas.

It is easier to commute between the terms AI and GenAI, but to incorporate GenAI in software, especially educational software, it is mandatory to understand the main differences between AI and GenAI. GenAI is a subset of AI that focuses on the usage of algorithms and the implementation of certain architectural approaches to generate content in various forms (Sengar et al., 2025).

AI can be considered the general term, being the area of computer science that aims to study and develop software that uses algorithms in order to simulate human intelligence in a computational machine (Generative artificial intelligence, n.d.). AI is usually concerned with solving problems such as classification, prediction or data analysis with different approaches

(Russell & Norvig, 2021) while GenAI's purpose is solely to generate content in various forms by implementing models with NLP.

Prospects of educational technologies empowered by GenAI

The usage of software that incorporates AI at its core, especially in educational contexts, sparked some controversy between all the entities that participate in educational processes. Each participant's perspective in this educational context is valuable; however, students' viewpoints differ from those of teachers, as they tend to focus on distinct aspects of how AI should be implemented and integrated into educational software. Besides these, we have to also acknowledge that a general factor of controversy exists regarding ethical considerations of AI integration in educational tools, accessibility issues and data leakage and privacy (Eden et al., 2024).

Much of the research conducted on how students engage with GenAI tools is focused on students enrolled either in high school or students pursuing courses to achieve a higher education degree. The studied group gets even smaller because most of the research data examines how students enrolled in STEM or technical courses engage with such solutions (Kohen-Vacs et al., 2025). A significant amount is focused on the preservation of critical thinking of the students while engaging with GenAI solutions (Bejar et al., 2024), stating that students should be more aware of the content that LLM solutions generate and they should not solely rely on it without validating it first.

Existing literature in this regard is also concentrated on studying how the usage of GenAI may impact students' ethics in academic contexts. Sabbaghan and Eaton (2025) examine how graduate students assess GenAI in research contexts, emphasizing that human intervention and decision making in the AI driven research process is crucial, but it needs to be adapted to the requirements brought by the era of AI.

Teachers' perspective in this regard is different solely because AI is seen either as a tool that may help the teaching activities, training processes (Nygren et al., 2025) and the generation of educational content or as a system that is difficult to use, a tool that may slow their processes down and hinder the critical thinking of the students. Despite the contradictory set of opinions among teachers, it is clear that AI can promote the inquiry in classrooms, when used accordingly (Ramnarain et al., 2025). What might seem to be tricky is not the benefit of the AI integration in educational technology, but the definition of a proper context that facilitates the preservation and development of original thinking skills of the students (Guillén-Yparrea & Hernández-Rodríguez, 2024).

Students might benefit from the integration of AI in educational technologies, especially if we look at how they tend to use the power of LLMs in their everyday lives. The most intriguing aspect of education, as we perceive it, is that it tends to follow a standard curriculum that might not be fitted to the students' needs. This is important, especially in learning scenarios where students tend to face difficulties learning intricate subjects, highlighting the importance of receiving feedback (Ekizer, 2025) along the way. LLMs can be helpful, especially because they can use their NLP to simulate understanding, making it easier to "support" students in their educational journeys. The downside in this matter is that the generated content or the given advice should be verified and not blindly trusted (Zapata et al., 2024). Many students tend to incorporate AI tools for exam preparations to take full advantage of the capabilities of LLMs, but that requires a proper level of AI literacy.

The concept of AI literacy gained popularity in the last years, being a key factor in integrating AI technologies well into educational processes and methodologies. There are a variety of definitions trying to explain AI literacy as it is a relatively new concept in the field, but all of

them are centred around the knowledge and skills that individuals should possess to facilitate the engagement with an AI system (Choi et al., 2025).

The level of AI literacy that students have differs and the existing literature that analyzes the use cases and impact of AI solutions, especially GenAI tools, tends to be biased, focusing on the majority of the cases of students mainly enrolled in Engineering and Computer Science courses. This might happen due to the fact that engineers and programmers embraced the benefits that AI brings in their processes. The uses-case that these students identify that can be improved by AI vary from code-formatting to debugging programs, generating code snippets and understanding of complex problems (Hwang & Lee, 2025). These students usually use GenAI, having a relatively high level of understanding of basic and advanced AI concepts. They are familiar with concepts such as prompt engineering which can translate in how well they maneuver a LLM.

Social sciences and linguistics are the domains that follow the STEM research in the area that studies GenAI's impact in students' task completion. Numerous studies try to analyze the impact of such tools, especially in situations where someone would need assistance often to ensure that the learning process is going well. This is why the existing literature is focused on studying how GenAI tools can be implemented effectively to assist students in learning foreign languages (Liu et al., 2025), or in understanding difficult social situations while preserving their critical thinking and academic integrity skills.

There are a multitude of situations in which GenAI is used by the teachers. Some professors use it as an assistant (Moundridou et al., 2024), (Ramnarain et al., 2025) that helps them through the process of designing lesson plans and inquiry strategies in order to engage more with their students while teaching. Others may find utility in AI as a tool that helps them with their time management and organizational activities. The integration of GenAI tools in teaching activities can prove beneficial for teachers, especially in key teaching areas such as assessment of the students (Cotton et al., 2024). Assessment comes in many forms, depending on what the teacher considers fit to assess in a specific scenario. The most popular types of assessment that the teachers do include exams, scientific papers, projects and presentations (Cotton et al., 2024).

There is a concern to be noted, considering how GenAI can help teachers in their assessment processes. If we were to shift the perspective on which entity is doing the assessment, making the teacher just a peer reviewer of the GenAI's assessment skills, we need to mention that AI models, unlike human teachers, lack a specific skill set oriented on teaching competencies that may limit them on creating meaningful and correct assessment in every educational context. The existing literature focused on the taxonomy of learning and teaching competencies (Anderson & Krathwohl, 2001; Bloom, 1956) is concentrated on a greater skill set that teachers should possess in order to make good evaluations.

Thus, if we combine that base skill set with the digital teaching competencies that are mandatory in today's society (Fernández-Batanero et al., 2021) we would look at the concept of the teacher as we know it today. An AI model is not an entity that undergoes a classical training process, like teachers do by attending school, university and courses. It follows a training data driven process that allows it to possess right from the start the digital skills required for teaching. Thus, GenAI does not have emotional intelligence or the capacity to properly understand the state and flow of a physical class in order to mitigate noise in the classroom or to make students more alert in order to pay attention to what is being taught.

Ethical concerns

Educational platforms benefit from the integration of GenAI in their architecture or their use cases, primarily because GenAI models do not need to be created whenever a specific piece of software requires this type of integration, they can be called and providers such as OpenAI enables this feature via an API (Application Programming Interface) call that lets systems use the model that they need.

The integration of AI technologies in education does not only concern teachers and students, but also institutions, being an aspect that reshapes the whole field of Education. Additionally, if we take into account the ethical aspects of the problem, faced both by students and teachers, it is mandatory for governmental institutions to ensure that policies and regulations are put in place to ensure the proper usage of such technological advancements. The only issue in this regard is that in order to have policies destined for the educational software you need to have well-grounded policies for the general usage of AI, policies that can be extended in other fields as well.

Current trends and competitors in GenAI market

In terms of popularity, the AI market for GenAI software is vast, offering a variety of options to best suit the needs of the users. If we analyze the students' point of view, we can see that ChatGPT is their first choice, being the most popular software that they use in their everyday academic tasks (Guillén-Yparrea & Hernández-Rodríguez, 2024).

The main reasons why ChatGPT is such a convenient solution for students can be divided in two categories: accessibility and financial. In terms of accessibility ChatGPT was the first popular LLM that was open to the public. Being the first led to obtaining a market advantage, especially because it performed extremely well for a free solution, registering an approval in terms of how often the models that can be accessed through this platform tend to hallucinate. Financially it is safe to say that ChatGPT is mainly a free option that can be perfectly used without upgrading to a paid plan for small tasks. Despite ChatGPT being the most popular tools, it should be mentioned that solutions like GeminiAI or Claude are also strong choices among students, but in context with a certain level of specificity, requiring a tool that performs better in such scenarios.

The existing competitors on the GenAI tool market raised a standard, especially if we look at the tech industry from this perspective. This aspect made companies focused on delivering products marketed as productivity tools to develop their own models to assist their users in task completion processes. Such productivity tools are used by the students, especially for organizing and note-taking, despite not being considered official educational platforms. This is why products such as Notion, Canva or any other productivity applications now offer their users the possibility to access their own AI agents that usually can act as GenAI models.

Methodology

To address the topic of this study in an organized and methodical way, we have followed a set of rigorous protocols involving both theoretical and practical research. This paper followed a semi-structured approach both in terms of organisation and results presentation.

The results were presented in a narrative manner that explains the perceptions collected from a group of individuals directly related to the context of this research. The stages of the adopted methodology are presented and summarized, in a flow chart, below (Figure 1):

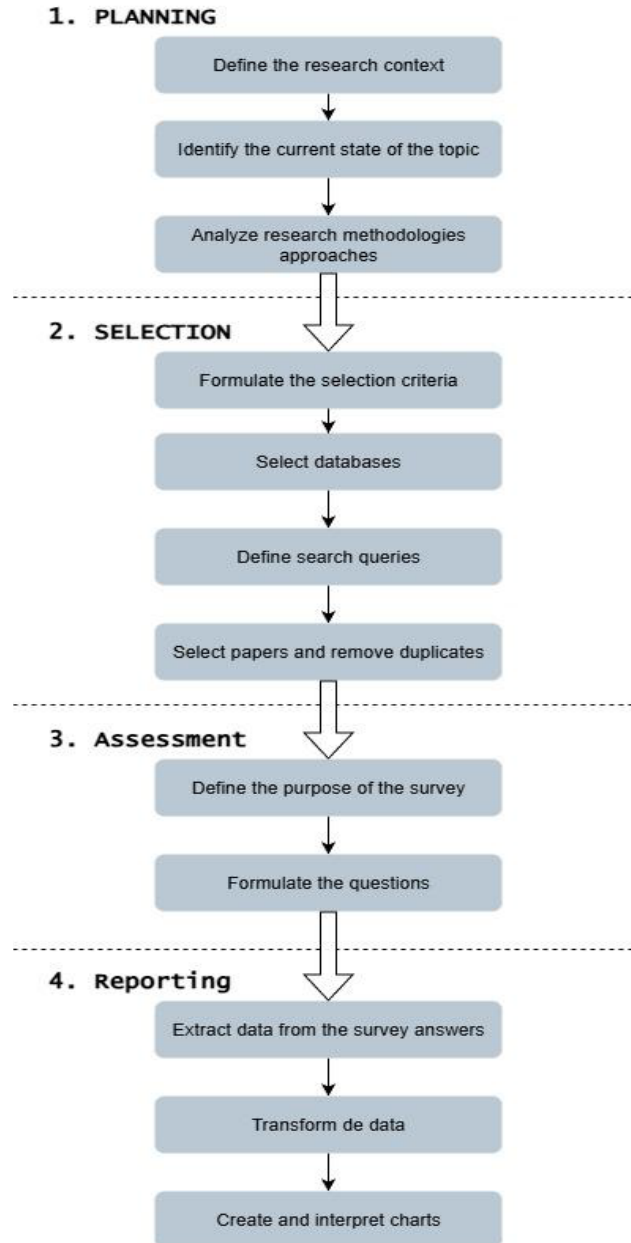


Figure 1. Research methodology workflow

Source: Authors' own research.

I. Review of current research and existing literature

The first step was carried out with the aim of conducting a comprehensive review of the existing specialized literature in order to examine the current state of research regarding educational practices in the current transforming era. The goal was to identify and analyze possible solutions and emerging trends (particularly in artificial intelligence) within an educational context: learning, teaching and evaluating. This initial stage provided, overall, a solid foundation that underpinned the subsequent phases of the study.

The existing literature that highlights aspects of the integration of GenAI in educational contexts is extremely comprehensive. It was necessary to narrow down the quantity of the materials to obtain a solid foundation of knowledge that can sustain the research. In order to achieve this, we

had to set a well-defined selection criteria in order to pinpoint the materials as much as possible to only obtain what was strongly related to the discussed topic. The selection criteria included crucial aspects such as: language of the paper, year of publication, keywords, content relevance to the discussed topic and presentation method.

All of the studied articles were written in English and published recently, between 2020 and 2025. There are some exceptions that were allowed mostly on the articles that sustain the knowledge foundation on taxonomies regarding education and teaching competencies. The only situation in which exceptions occurred for papers related to AI and educational context referred to papers that represent the foundation in the AI field or that presents concepts that did not face major changes in the last decade. Several international databases were queried to achieve the final number of 25 articles such as: Web of Science, Springer or IEEE.

II. Examining current Generative AI solutions and their usage

The main goal of this section is to present the most widely used Generative AI tools in 2025 and examine which are specifically designed for the educational sector. Additionally, consideration will be given to conducting a comparative technical analysis in order to identify the underlying core technologies that form the foundation of these modern AI tools, thereby providing an overall picture of the growing interest in investing in innovation within the field of education.

After that, it will be highlighted how AI tools are organized according to specific sub-activities for each user group (valid for both sides: students and teachers). It should also be noted that, at this level, the main focus is placed on the density of tools within each sector. In this regard, the aim is to highlight those areas that are more strongly supported by IT solutions, as well as those that are less developed from this perspective.

III. Survey investigating AI Tool adoption in educational practice

The most important technique employed in the study is the survey. This was mainly created and distributed to collect qualitative data. Its purpose was to gain a deeper understanding of which AI tools are used by students and teachers within the educational process based on the theoretical findings exposed in the above section. The survey also explored perceived positive and negative impacts, concerns or fears associated with AI's use especially regarding the role of teachers.

IV. Reflection and conclusions

The final section of this writing synthesizes the principal results, concluding the absolute benefit and necessity of integrating Generative AI in education, as well as the recommendations for further applications and research directions aimed at advancing the education of the future.

Methodological analysis of AI Tools in 2025

The primary focus is to identify the most recent generative tools from 2025, with the aim of analyzing how many of these are specifically dedicated for educational purposes. For this objective, the analysis started from the dataset available on Kaggle, which contains information about the most important Generative AI tools in 2025, covering areas such as text, image, video, audio and more. Each record includes details about the developing company, release year, open-source status, available APIs and methods used. This dataset highlights overall the growth, diversity and innovation of AI technologies shaping the digital future.

For this specific analysis, the data were processed to retain only the relevant information regarding the tool name, main domain of use and release year. Platforms that belonged strictly to a particular region were kept and information about the country and continent of origin was added afterward. From the whole dataset downloaded from the source, after processing, a total number

of 88 tools remained, each subsequently classified into standard domains such as: Education, Audio, LLM, Design, Cloud, Coding and more.

Survey deployment

As previously mentioned, the present research employs a questionnaire-based survey method (approached from a mixed-methods investigation perspective) as the primary instrument for collecting empirical data. The sample of respondents was selected randomly, to ensure the inclusion of participants from the main yet distinct pillars of the educational ecosystem (namely both teachers and learners), alongside a complementary vision provided by some experts in the field of Information Technology (IT).

This combination provides greater reliability from the perspective of cross-validation of the collected data, supporting a multidimensional analysis of the transformation phenomenon applied to contemporary education. The entire study is designed to investigate the correlation between the structural barriers perceived by end users and the transformative potential offered by GenAI technology, evaluating the actual impact of these innovative technologies on the efficiency and quality of both pedagogical and academic activities. This created survey integrates both structured questions (closed-ended) and open-ended questions, allowing participants to freely express their subjective perceptions. In order to ensure rigorous collection of both quantitative data (necessary for statistical validation) and qualitative data (to deepen the analysis), the questionnaire is organized into six main sections, each having a clearly defined purpose and dedicated for a specific category of respondent: learner, teacher or IT expert/researcher. The survey is composed of the following parts:

- *Section 1 (Research Purpose and Ethics)* - This first stage focuses on presenting the purpose of the research to the respondents and also on establishing confidentiality parameters; all in full compliance with GDPR (General Data Protection Regulation) and with the principles of academic ethics.
- *Section 2 (Socio-Professional Profile)* - This section aims to map the respondents according to role, field of activity and self-perceived digital competencies, these variables being used in the subsequent data analysis.
- *Sections 3 and 4 (Impact of Generative AI on Teaching and Learning)* - These two mutually exclusive sections are tailored to examine the use and impact of GenAI in educational contexts from the perspective of two primary type of actors from the educational sector: learners and instructors, respectively. The analysis focused on AI's role in supporting teaching and learning activities, as well as participants' perceptions of efficiency, autonomy, quality of educational processes and challenges associated with its educational use.
- *Section 5 (Comparative Technology Analysis)* - This segment of the survey is managed to evaluate the participant experience with various GenAI tools for educational activities that they used or still tend to. The other purpose is to identify dominant technological preferences and possible patterns.
- *Section 6 (Prospective, Patterns and Emerging Trends in AI on short, medium and long term)* - This applied questionnaire concludes with specific questions focused on trend analysis, aimed at outlining a synthetic perspective on the evolution of education across three time horizons: short, medium and long-term (all intended to provide as comprehensive as possible a picture of the future of education, as perceived through the respondents' perspectives). From the structural point of view, this part is mainly built from open-ended

questions, so all the qualitative data extracted from the responses concludes the key formulation of possible educational policy proposals and best practices.

Based on the systematic architecture, this used research instrument fully covers the critical points of the analysis: from subjective limitations and solutions identified through AI tools to strategic expectations regarding the future of education.

Results and discussions

The results of the present study first focus on identifying the top Generative AI tools available in 2025 and those used in education, in order to understand how they are applied. In the next section, the authors examine the frequency and extent of integration of these tools in the activities carried out by students and teachers, highlighting the types of tasks they support, such as administrative work, content generation or educational support. In the final part, the analysis focuses on the results of the survey administered to students, teachers and IT experts, aiming to investigate their perceptions of Generative AI technology, the perceived positive and negative impacts and the anticipated trends in its use.

Analysis on Generative AI adoption in education

In this context, utilizing the Kaggle repository (Yaseen, 2025), the analysis began by classifying the GenAI landscape by domain to highlight how many are specifically dedicated to education or can be used in educational settings.

From the 13 domains for which data is available after the processing, a top 8 ranking was created to highlight the distribution of the most relevant categories. As shown in Figure 2, based on the analysis of all 88 included tools, around 23% are dedicated to LLMs category, followed by 17% focused on audio processing and 13% allocated to design. It can be observed that a major proportion, 12%, corresponds to coding tools; while the Education domain accounts for 10% of all identified solutions from the top 8 Domains.

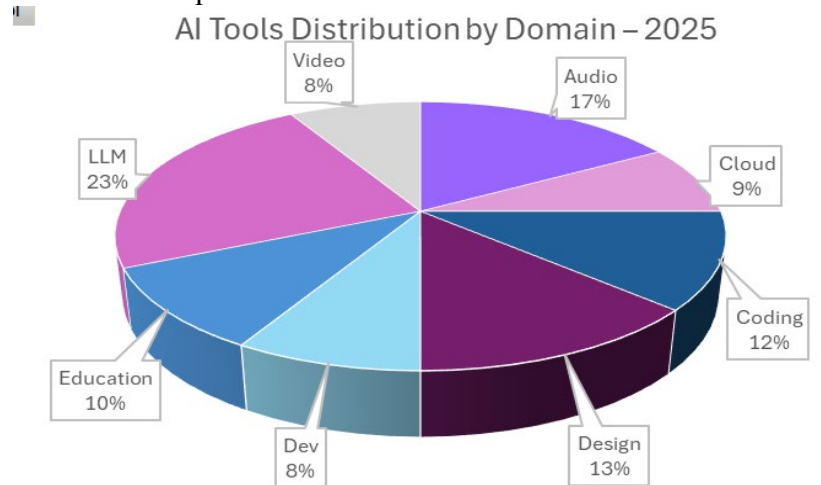


Figure 2. Distribution of AI Tools by domain (2025)

Source: Authors' own research.

The position of the education segment in the first 10 indicates that AI tools are actively used in this learning-teaching-evaluating sector and it represents a priority. Thus, education positions itself as a strategic domain in the adoption of emerging technologies, with an accelerated pace of AI integration. Additionally, cloud-related tools represent 9%, while video and

development domains each account for 8%; in this way completing the overall picture of the main directions of development within the AI ecosystem for 2025.

Next, the analysis continued with a deeper approach regarding the key characteristics of these GenAI tools dedicated exclusively to the educational sphere. As such, from all the platforms available and analysed above, only those strictly educational ones were selected and informations were gathered on more technical aspects such as: costs, additional integrations, as well as the underlying technology. As can be seen in Table 1, most of these analyzed tools offer a free version, but on demand there are also some optional premium plans that can extend the available standard functionalities. All of these tools can be used in teachers' activities too and are compatible with various educational applications and platforms.

From a technical perspective, these platforms are based on emerging technologies such as LLM, Transformers, Deep Learning and, in the case of Generative Visual Platforms, Multimodal AI and NPL (Natural Language Processing). Because of this, all of the above-mentioned tools can produce a wide range of educational content, including explanatory texts, exercises, lesson plans, slides and visual presentations.

Table 1. Comparative Analysis of 2025 AI Tools

Tool	Cost & licensing	Integration / compatibility	Content generation	Emerging technology behind
ChatGPT	Freemium, Plus, around \$20/month	Standard API for integration into applications	Educational texts, explanations, exercises	Large Language Models (LLM), Transformer AI, Deep Learning
Claude	Freemium or Enterprise	Standard API available	Explanatory texts, lesson Q&A	LLM, Transformer AI, Contextual AI
Gemini	Enterprise, but still some free features available	API for educational applications	Educational texts, explanations	LLM, Transformer AI, Deep Learning
Notion AI	Freemium, around \$8–16/month	Integration with apps like: Slack, Google Drive or Trello	Notes, lesson plans, worksheets	LLM, AI-assisted productivity, NLP
Tome AI	Freemium, based on paid plans	Import/Export of text and slides	Visual presentations, storytelling, multimedia content	Generative AI, Multimodal AI (text + visual), LLM
SlidesAI.io	Freemium, based on paid plans	Import text from Word/Google Docs, export PPTX/PDF	Educational slides, presentations, visual summaries	Generative AI, LLM, NLP

Source: Authors' own research.

In the following section, we highlight the entire landscape of AI tools available for the two categories of end-users: students and teachers, respectively, along with their specific areas of activity. In this way, the potential brought by these technologies can be easily observed, as well as the branches in which this involvement is more concentrated.

Emerging technologies for students and teachers: a comprehensive approach

To further strengthen the analysis and the qualitative findings, the investigation continues with an examination of AI solutions available for both sides: learners and educators. In this regard, an AI platform was used, an aggregated tool that can be compared to a database in terms of purpose and structure. This platform, (Toolerific, 2024), was selected due to its organizational framework and

This platform has a dedicated section where for each specific role (in our case: teacher or student), the entire existing marketplace of AI tools can be reviewed. The output is visualized in a flower-like structure (figures 3 and 5 for reference), where each branch represents a category of activity. The important fact to be mentioned is that, at the end of each branch, the names and direct links to that tool are present. Additionally, the use of different branch colors helps distinguish between various types of activities or academic workflows.

Student side opportunities

The focus is primarily on which AI platforms are oriented towards students and which are the most predominant categories they belong to. As can be seen in figure 3, the visual map consists of several main sectors, each corresponding to an essential academic or administrative activity, such as: take exams, submit assignments, apply for admission, attend orientation, attend classes or graduation.

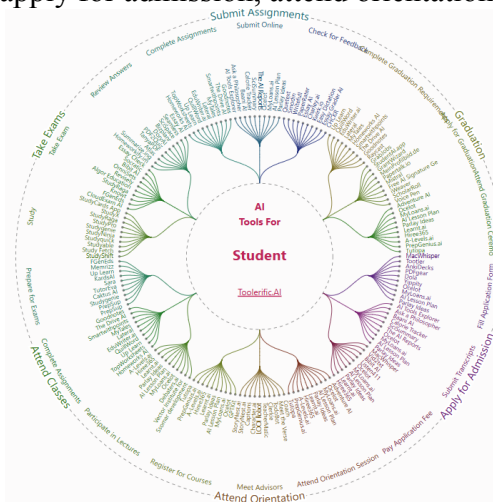


Figure 3. Flower structure – Student destined AI tools

Source: Retrieved from Tolerif.AI aggregator.

Accordingly, these are the most important sectors for which AI-based digital platforms exist globally. Each main branch of the map is further subdivided into sub-branches that list specific functionalities or actions (e.g., “Submit Online”, “Check for Feedback”, “Register for Courses”). The flower generated in the output indicates different AI tools available for the student role, each of them with specific purposes. Most of the available tools for the student role seem to focus on the core learning process, providing support through key functionalities that facilitate for example: online submission of assignments or feedback, deadline tracking and, in some cases of course, automated grading.

The main branch is designated as Submit Assignments. Its high density reflects the importance of this activity in the learning process, as AI supports both students, through quick feedback; but also organization and instructors, through the automation of repetitive tasks. Following this, the next large area corresponds to the Take Exams category, which includes sub-branches for exam scheduling, access to materials and submission of answers. This main branch certainly is highly populated because of the associated importance. For all types of end users,

exams are critical for assessing academic performance; so in fact, it require numerous tools to ensure the accuracy and integrity of this process.

Next, in terms of density, as can be observed in the map from Figure 4, the predominant section is Attend Classes, which covers numerous activities like: participation in lessons, examining lectures and attendance tracking. This section is populated because it involves several functionalities related to student engagement, collection of participation data and access to materials, essential aspects for maintaining the continuity of the learning process.

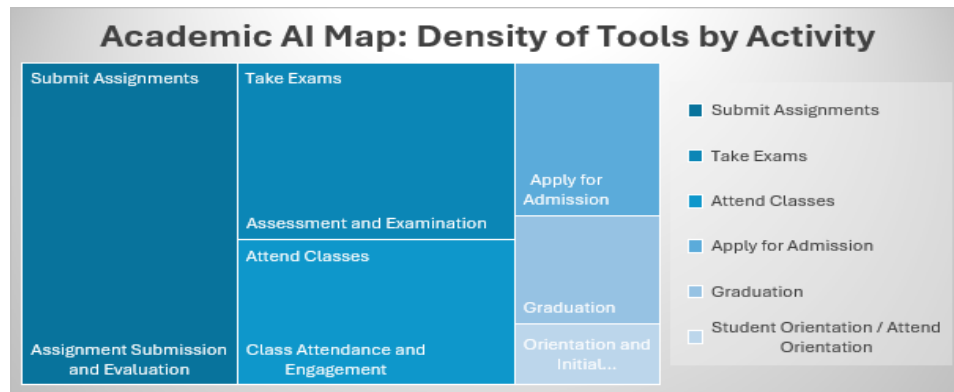


Figure 4. Academic AI usage map

Source: Authors' own research.

Apply for Admission follows, populated due to sub-branches for submitting applications, uploading documents and tracking application status. Even if it has fewer sub-branches than the academic ones, its density is significant for effectively managing initial administrative workflows. The Graduation area is less populated even if it is focused on eligibility verification, diploma requests and ceremony scheduling. Although it is essential, because of the actions number and the available tools involved, the branch indeed is smaller compared to the other ones (assignment and exams); which is the reason of its “thinness” on the map.

Finally, the least densely (based on the output) is the area related to the Student Orientation, which is managed to gather all the AI tools that provide support to students at the beginning of their academic journey. This branch also includes more limited actions, but they are critical for the initial integration of students into the academic environment and familiarization with institutional resources and regulations. Based on this aspect, we can obtain a valuable point, that new AI tools for this category can be developed and become really useful (based on the limited existing ones).

This analysis that continues in the following section is dedicated to the teacher's perspective. This time, we identify the AI tools available for instructors based on the key branches that support their pedagogical and administrative activities.

Teacher side opportunities

The teacher is placed on the other side of the desk, and for his role numerous tools can be integrated into tasks like: administrative processes (organization, record-keeping), material preparation, feedback provision or the act of teaching itself as a component of the whole educational context. Accordingly, Toolerific.AI database also retrieves the available intelligent platforms that align with the specific activities of teaching staff.

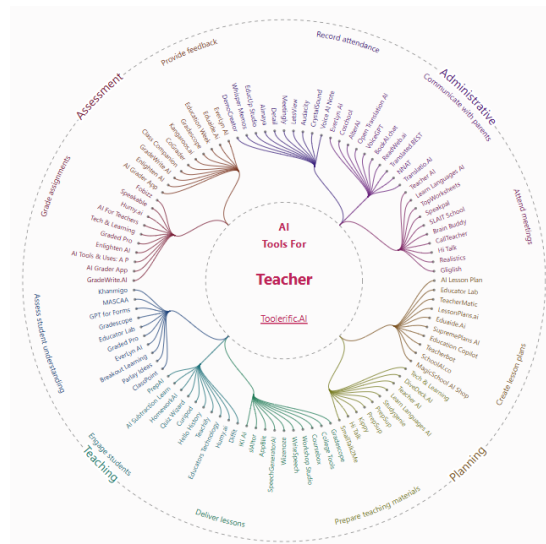


Figure 5. Flower structure – Teacher intended AI tools

Source: Retrieved from Tolerif.AI aggregator.

At first sight (as illustrated in Figures 5 and 6, but also based on the last section's findings), the options available for teachers are not so numerous as those available for the students' side. The domains identified are four in number, namely: Assessment, Administrative, Teaching and Planning.

Also, for the pedagogical role, the resulting visual map is presented in an extremely concise form; each density being associated with the full range of AI tools intended for teachers' activities domains. The most dominant section of the map is Assessment, as it includes the most numerous and important activities such as: test generation and administration, automated grading and provision of personalized feedback. This fact reflects the abundance of AI solutions aimed at streamlining assessment processes. The next category is Teaching, another branch that is nearly as wide, involving tools related to: explaining and generating educational content, adapting materials to students' levels and supporting interactive instruction. This suggests that AI plays an increasingly significant role in the pedagogical process, mainly for the indispensable personalization of the teaching act.

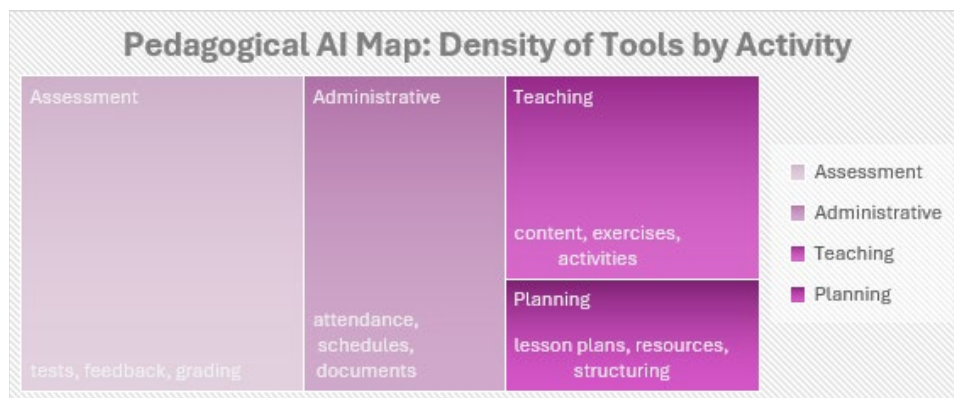


Figure 6. Pedagogical AI density map

Source: Authors' own research.

Next, in third position is placed the Administrative sector, which exhibits a moderate level of representation. This branch includes especially platforms designed for organizing school activities (from managing attendance and facilitating communication, to producing documents), which suggests a moderate degree of diversification in AI tools within this segment. The least represented domain is Planning (where tools focus on the preparation of lesson plans and instructional materials), indicating that, although AI supports the lesson design phase, the availability of specific solutions is more limited than in the other domains. This may also reflect the tendency of teachers to organize their lessons individually rather than with AI-assisted tools.

In brief to the aspects presented, there is a clear and widespread interest in integrating AI into education, which is reflected in the positioning of the education sector among the top 10 domains for the most generative solutions in 2025. Furthermore, it is notable that all intelligent tools dedicated to education, as captured in this dataset and ranking, are based on Large Language Models. The trend points toward increasingly flexible, interactive and personalized engagement with intelligent tools, while still requiring input and guidance from the end user. This aspect indicates that, even if technology provides substantial advantage, users should remain in control of the process and must actively get involved to fully leverage the system.

Those two visual maps created and represented above, show that AI and its capabilities are distributed across multiple pathways, supporting an entire and complex framework, valid for both sides: students and teachers. The options are numerous in both contexts; therefore, what is needed are initiatives to integrate these tools into all the educational processes (from learning and teaching, to assessment).

The truly impressive idea (based on the analysis) is that, through the varying density of the domains, areas for assessment and teaching are the most dominant in concentration terms. These results highlight that both these two main activities are prepared for a major transformation. In other words, the future of education is moving toward a model in which adaptive assessment and personalized instruction become the norm and not an exception.

The analyses presented in the previous subsections have shown that emerging technologies can function as a 360° educational assistant, capable of optimizing every stage of the educational process.

Survey-based insights into Generative AI in education

As already stated in the Methodology section, the survey was designed based on five sections to thoroughly capture all relevant information: from including respondents' backgrounds, their experience and literacy with GenAI solutions, to perceptions and evaluations of its use in educational contexts. The sample comprised 89 participants which includes: 51 students, 22 teachers, 2 researchers and 14 IT professionals.

First of all, each participant associates AI in education with a key innovative aspect. Overall, participants view Generative AI as a powerful and transformative educational tool, particularly for personalizing learning, enhancing efficiency and fostering creativity. Besides these aspects, as we can see in the word cloud below, GenAI use raises concerns regarding excessive automation, cognitive dependency and the accuracy of information. That being noted, we need some critical and mindful implementations in each part of the educational environment (Figure 7).

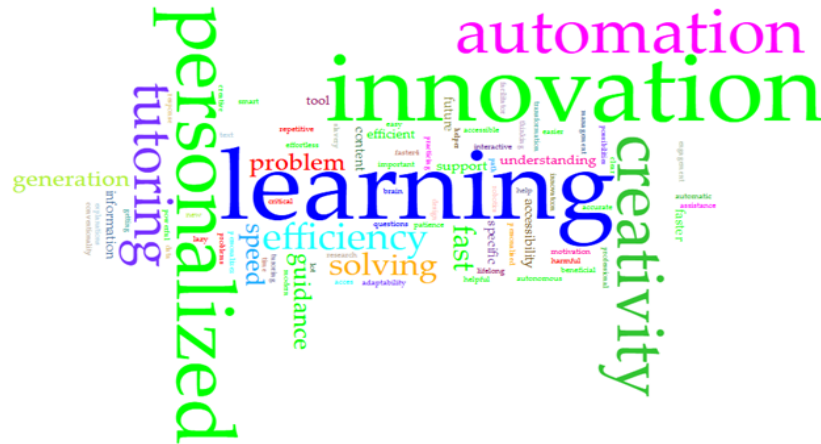


Figure 7. Word cloud of AI key in education

Source: Authors' own research.

The survey's initial section was designed to profile the participants and provide essential contextual information regarding their background. Most participants of the survey, around 79.8% of the total respondents are affiliated with STEM disciplines, either through their work, teaching responsibilities or area of study. The remaining participants represent other areas such as: arts, medicine and related domains. Based on these aspects, the respondents were part of different fields (not just STEM or IT), so the validity of data and respondents' randomness can be guaranteed.

An important finding concerns the use of Generative AI: all of the respondents reported actively employing it in their daily pedagogical, professional or academic activities. When asked to self-assess their experience with educational and AI-related tools, 54.5% described themselves as having advanced experience, 26.3% as intermediates, 10.1% as experts and respectively 9,1% as beginners. These results indicate that more than half of the participants possess a solid understanding of AI technologies and their capabilities. This majority represents those proficient and also regular users of advanced AI tools. Their declared high level of familiarity suggests for our analysis that the sample is well-selected to provide informed insights regarding the impact and integration of GenAI in educational contexts.

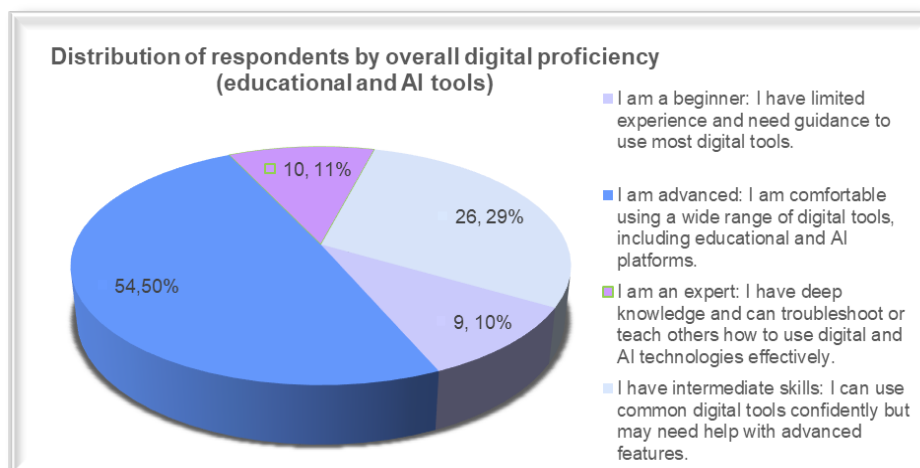


Figure 8. Digital proficiency levels of respondents

Source: Authors' own research.

The following section of the survey is strictly dedicated to pupils and students. Its scope is to examine the participants' visions of the usefulness of AI in education, the types of educational activities in which they tend to integrate it, as well as the limitations experienced in the learning process and the ways in which AI helps mitigate them. Around 72.9% of the respondents belong to the age groups 18–24 years and for the 25–34 years group we have associated 24.3%. This indicates that the majority of the analyzed sample consists of students.

Regarding the perceived usefulness of AI in the learning process, almost half of the respondents (44.3%) rated it 4 on a scale from 1 to 5, while 30% gave the maximum rating. A percentage of 23% indicated a moderate level of usefulness, corresponding to a score of 3.

Concerning the educational activities for which AI is used, the most frequently mentioned option was support in understanding concepts (85.7%). This predominant selection suggests that students perceive AI more like a true tutoring tool, used especially in critical situations, when they encounter conceptual difficulties. A majority percentage, around 84.3% of the participants, reported that they use AI to obtain additional explanations or supplementary educational resources, reinforcing the idea that AI tools serve as informational support in students' learning process.

Other selected options were related to other specific activities like: writing and structuring texts (68.6%), exam preparation (around 61.4%), problem-solving (61.4%), as well as personalized learning (25.8%) and, of course, time management (12.9%).

For gathering the limitations they feel in education, an open question was included in this survey's section. For this matter one respondent noted: *"One of the main challenges I faced in my learning was understanding complex concepts, especially when the explanations in textbooks or lectures were too technical. I also struggled with time management and organizing my study schedule effectively"*. Another participant added the following: *"You rarely ever find someone who can take code and explain every line/ every section to you. AI greatly helped me understand how to code"*. Students also seem to struggle identifying relevant learning resources and their trust is on AI tools' capabilities: *"Faced difficulties narrowing down potential research materials; AI can help generate a shortlist of the most relevant texts"*. Based on the obtained responses, we classified them on topics and GenAI was seen as highly effective in addressing all of the existing challenges somehow:

- Conceptual clarification: *"AI has helped by explaining ideas in simple ways, giving examples and keeping me on track, making learning faster."*
- Problem-solving guidance: *"AI guided me through step-by-step solutions without directly giving me the answer, helping me understand the logic and build critical thinking skills."*
- Time and content management: *"AI helped me organize my tasks better by creating work plans and quickly summarizing long materials. These tools made the learning process more efficient and helped me save time."*
- Writing support: *"AI tools help by giving me outlines, clearer phrasing and example drafts, which makes it easier for me to begin and shape my writing."*
- Material synthesis: *"Whenever I feel this is taking too much to read, I use AI to summarize the content or find a specific detail."*

However, some students also noted limitations such as mistakes and partial outputs. In other words, they are not fully unaware of the situation: *"It does have a lot of errors, so you cannot 100% rely on it to do everything; if you do not know what is going on, the tool is useless"*. But overall, GenAI operates as a cognitive and organizational assistance, enhancing efficiency, understanding and problem-solving; however, requiring critical and reflective use to maximize its true value.

In the below figure 9, it is represented a spider (radar) chart summarizing students' perceptions of AI in their learning process across six key and predefined dimensions such as: overall usefulness, understanding content faster, learning efficiency, independence, time savings and also motivation. Each axis of the chart represents one dimension from the ones already mentioned, with values ranging from 1 (associated with lowest agreement) to maximum of value 5 (for highest agreement).

The chart was designed as an adapted Likert scale with value from 1 to 5, but with 0.5 as increments. Based on all the received responses, it can be observed that students perceive AI as most effective for understanding content, improving learning efficiency and reducing time spent searching as the average associated ratings are consistently high (around 4.4–4.5). In contrast, independence in learning and motivation received lower and ratings (around 3.3–3.4), indicating a more reserved attitude regarding these two aspects. That being added, AI in education seems to be widely appreciated as a cognitive and organizational support tool, as its impact on points like fostering independent learning or intrinsic motivation is less pronounced.

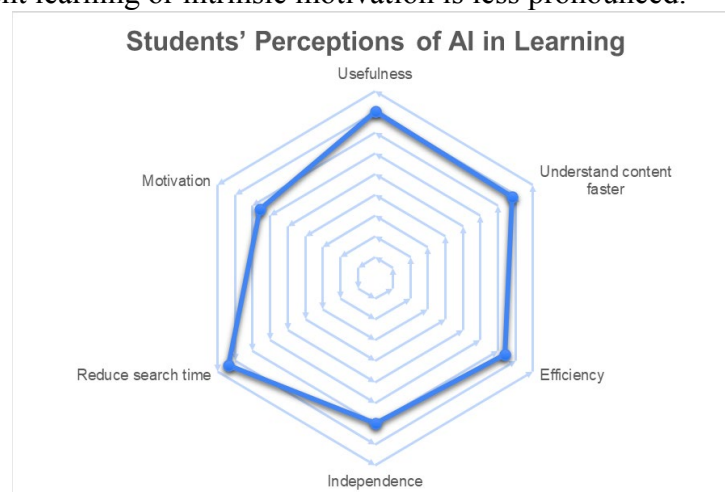


Figure 9. Evaluation of AI-Enhanced Learning metrics

Source: Authors' own research.

This next part of the investigation is focused on teacher role analysis. The respondents to our applied survey have extensive teaching experience, as 47.4% of the participants own over 10 years' experience in education (47.4%), while 36.9% of respondents reported 1–3 years of experience. When they are asked regarding the activities in which they use AI, the most frequently selected options were: creating teaching materials selected by 84.2% of the participants, lesson planning and generating tests/exercises (with 52.6% of responses), followed by providing student feedback (31.6%) but also progress monitoring and management tasks (15.8%).

When they were asked, *“What are the main challenges in using AI in teaching?”*, most respondents indicated general ethical issues and low accuracy of some results (57.9% each). Other challenges that were specified in the responses point to structural issues that restrict the necessary development of AI literacy. Others, around 26.3%, claimed the absence of some clear institutional guidelines. Around 42.1% of the teachers mentioned also the lack of time felt once they are in the position to familiarize themselves with AI tools and their full range of benefits. The detailed perspectives and more other ones show that these existing challenges restricts teachers' ability to systematically develop and transfer AI-related competencies to students. In time, this lack of

support approaches will affect the responsible and effective use of AI tools by both parts (teachers and learners).

Most teachers considered AI training to be useful, highlighting that not all colleagues are familiar with these tools and most of the time struggle to use them: *“For me particularly, not, but it would be useful to attend a training, as not all my colleagues know how to work with an AI tool and they struggle with it.”* The main topics identified as relevant for training include creating AI-based learning materials (*“It is an amazing tool if used properly by the teachers. I believe that using AI is best in developing new learning materials.”*), automated assessment, personalized learning support, ethical considerations, bias detection and basic AI literacy (*“It is necessary to know the basics of AI to use it correctly in any situation.”*). All of these mentioned responses suggest the same necessary and absolute resolution: responsible and well-applied trainings that could support the development of pedagogical competencies, also enhance teaching efficiency and promote responsible use of AI in education (from all perspectives).

In Figure 10 from below, the average score of the perceptions ranges are represented. As shown in the graph, these values are between 3.6 and 4.3, indicating that AI is perceived by teachers in a generally positive yet cautious manner.

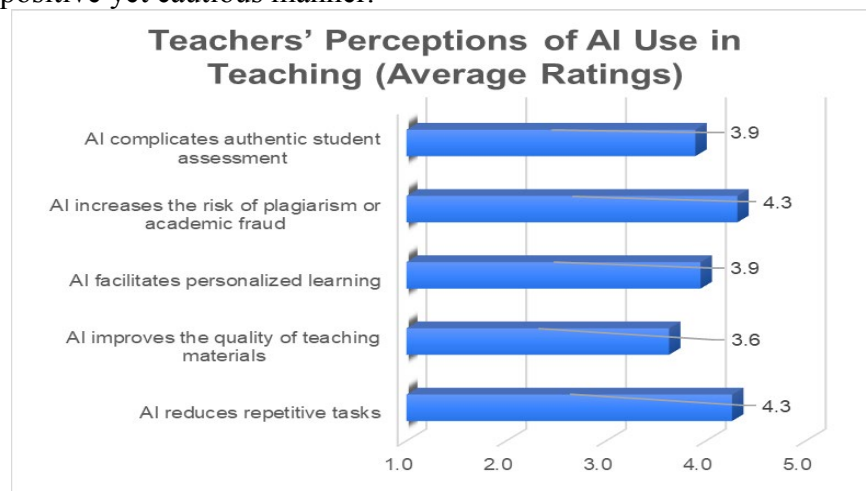


Figure 10. Pedagogical AI - impact scores

Source: Authors' own research.

Based on their responses, it is particularly valued for its effectiveness in reducing repetitive tasks. There were also raised some significant concerns regarding academic risks like plagiarism or ethics. Overall, it implies an attitude of moderate optimism toward its pedagogical potential in practice, as well as confidence in leveraging AI for content creation.

In the open part of this section, the participants listed a variety of additional AI tools used in their educational activities, indicating an increase in the use of AI in this field. Responses included tools such as: Deepseek, Claude AI, Notebook LM, Perplexity, Canva AI, Notion AI and Deepl Write, as well as specialized applications for video processing or programming with graphic blocks. Some participants also mentioned that they use custom AI tools developed by their work company (internal tools) which suggest a diversity in the choice of platforms. More than this, this insights demonstrates a general growing trend of integrating AI into our activity's day to day, as users seek solutions tailored to their specific needs.

Last but not least, the final section of the questionnaire, arguably the most intriguing, focuses on trends and perceptions regarding the short-term, medium-term and long-term impacts

of AI in education. The results were combined in a bar chart graph (Figure 11), each colour representing a time dimension review.

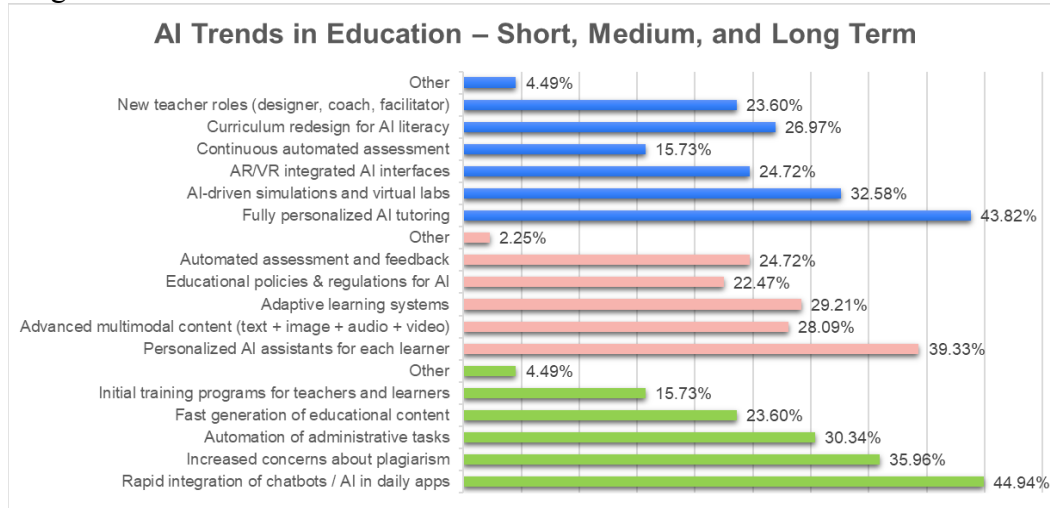


Figure 11. Timeline of AI integration in education

Source: Authors' own research.

In the short term (green bars in the above graph), survey respondents anticipate a rapid integration of chatbot and AI technologies in education, particularly for automating administrative tasks and supporting content generation. Over 44% of respondents believe that the AI integration in education will dominate the near future. Additionally, around 36% of participants highlighted concerns about academic integrity and plagiarism; reflecting a real amplified vigilance for the ethical impact of technology on education domain.

Associated with the medium term are the pink bars from the graph. As shown, 29.2% of respondents show a significant increase in interest in adaptive learning systems. This suggests that people expect, in the near future, that focus will be set on personalizing the learning process through AI assistants capable of providing individualized and tailored feedback. Furthermore, educational content will become more multimodal, combining text, images and videos to create a more diverse and interactive learning experience

The long-term trend is represented as blue bars in the trends graph. Most respondents (43.8%) expect a complete reconfiguration of the educational process, with a strong emphasis on fully personalized AI tutoring. This will enable an individualized learning model based on the needs of each student. Also, nearly 27% of respondents believe there will be a need for curriculum reform to incorporate advanced digital literacy skills. 24.7% of participants, in the same way, expect a significant impact from virtual and augmented reality technologies, in terms of creating more immersive and interactive educational experiences.

In response to the question about which trend can best improve education, the answers point directly to personalized learning as the main factor of change. Most people see AI tutoring systems and adaptive tools as the best way to improve traditional education, because this adaptability is an absolute necessary characteristic in this real transforming environment.

Secondary potential is attributed to VR/AR simulations and administrative automation. These two technologies are essentials tools for giving students practical experiences that cannot be easily recreated in normal classrooms. More than that, once integrated, these two also help teachers to save time so they can focus more on more important actions like guiding the students. Overall,

AI is seen not just as a tool, but as a capable engine of delivering individualized attention that continuously updates resources for every learner's necessity.

In response to the question: *"Which trend worries you the most and why do you think that?"*, the survey responses revealed some deep and complex concerns which involve both academic integrity and cognitive development too.

Along the way, many alarming responses collected from teachers were discovered. They are worried that the increasing use of AI can lead to loss of real intellectual effort. They do not put so much emphasis on plagiarism (which is becoming easier), but on the fact that the ability and capacity to learn is disappearing day by day. They consider this aspect indeed a great threat to humanity. One remarked acquired answer that need to be noted is the following: *"I'm worried that relying too much on AI could weaken critical thinking, problem-solving and the ability to learn on your own"*. Moreover, many responses referred to a necessary redefinition of curriculum that teachers are still waiting for. They state that their learners need to be educated in the field of responsible use of AI. The message was very clear, teachers are thinking about the well-being of students, saying that if measures are not taken, we will reach the point where we will raise *"generation that is overly dependent on technology"*.

The open-ended questions in the survey brought out a variety of interesting responses from teachers. One of them firmly argued that: *"AI can support learning, but the lack of empathy, nuance and human interaction is irreplaceable."* This fact was reiterated in other reactions from other respondents, also notable were inputs that conveyed concerns about changing professional roles, with teachers fearing that *"new roles for teachers could lead to unemployment"*. Also noting is their worry to integrate immersive tools such as AR and VR, that *"might disconnect students from the real world and human interaction."* In principle, their vision is that AI should function strictly as a supporting *"copilot"*, and not as a substitute for human judgment.

The move towards automated assessment, if analyzed from a more technical perspective, is considered potentially effective, but rather rigid. The question arises as to how creativity or subjective responses can be assessed and recognized. The rapid adoption of artificial intelligence, in the opinion of many, is taking place without adequate oversight; as one respondent mentioned: *"hastily implemented, without clarity, could create serious problems in the long term"*. Also worth mentioning at this level are both the economic impact and the training of the workforce, which remain topics that generate opposing opinions. While the long-term gains in terms of efficiency factors are recognized, these must certainly be balanced against the possible job losses and the deepening of the skills gap. According to the response received: *"not everyone is equipped with the necessary skills to compete in an AI-dominated job market"*, the transition to artificial intelligence in education must be managed with extreme care so as not to leave either teachers or students behind.

As for possible guidelines or best practices that could positively impact these effects of AI, respondents made several suggestions on these aspects. They emphasized the need for clear regulations that define how AI should be used to support learning, while maintaining academic integrity. Furthermore, schools should ensure that AI manages to fill or complement gaps through clear rules but not replace the student work.

Another aspect noted among the responses was the desire of teachers to be trained in the responsible use of AI tools. They argue that adequate training is needed, and that they will also guide their students in guiding them to use them effectively, without losing their role as mentors. Ethical concerns were addressed through possible guidelines aimed at preventing especially the

bias in AI models and ensuring the adequate use of student data. Furthermore, another critical concern mentioned was regarding data privacy. Some proper data protection policies were proposed, in accordance with clear standards such as GDPR, to guarantee the security of students' personal information. Finally, respondents recommended a solution for now, until the necessary steps are performed. The received suggestion was to limit for real the use of AI, endorsing a "60:40" model that can balance AI' role and maintain stability for human interaction in all educational environment (from teaching to learning and assessment).

On the whole, the discoveries of the applied survey highlight that GenAI is a valuable and auspicious component of the educational process, particularly for elevating performance and supporting the smooth understanding of learning materials. While ethical considerations and risk of over-reliance remain still relevant concerns on the list, these main two challenges point out the importance of responsible and well-regulated integration. Taken together, the final results of this study suggest that GenAI is not a fleeting trend, but a transformative force with a huge potential to shape the future of education, in line with its growing influence across multiple other domains.

Conclusion

According to this study, there is a growing trend toward the integration of artificial intelligence in all aspects of educational activities and participants are aware of both its benefits and its potential negative effects. Teachers, in particular, express concern that students may initiate to generate all or most of their work with AI tools, which will increase the risk of the loss of important and notable human qualities such as: creativity, original thinking and intuitive skills.

Currently, exist and are still being developed numerous IT solutions that are intended for students, especially, but also to teachers, in order to improve the educational process as much as possible. Studies indicate that users tend to look for quick and concise answers to their questions, and therefore the direction is towards large-scale linguistic models, a category frequently targeted as being current. We cannot say that there is a clear preference for a particular AI tool, but users claim that each is more stable in one channel and as such, they choose to either combine them or choose one tool at a time, depending on the respective need.

In relation to the density of effective adoption of artificial intelligence in education, it is observed that teachers have made fewer tools available and anyway, they tend to be reluctant to use them (therefore avoid somehow). On the other hand, students choose to actively use these IT solutions, having access to a fairly wide range, being increasingly anchored in this reality on AI. We expect that the future of education, shaped by artificial intelligence, will be a synergy between the individual and the AI sphere, where technology will not replace either teachers or students, but only empower them and increase their potential to the maximum. We can consolidate sketches of the educational future where emphasis is placed on Virtual and Augmented Reality, Intelligent Tutoring Systems and Predictive Analytics; these things making the learning process more adapted to the individual needs of each learner, immersive and equitable from an inclusion perspective.

However, there are numerous challenges that refer not to the actual process of adopting AI in education, but to how the collaboration between the parties takes place (teachers, learners, technology developers and decision-makers). All is to ensure its use in a stable, responsible and ethical way. It is clear that AI has become a true catalyst for what education can become; however, only through a clear and deliberate approach can we discuss about a harmonious environment, which develops through unique transformative steps and leads us toward an experience that is beneficial from all analyzed perspectives.

Among the limitations of this study is the first and foremost synthetic analysis of the use of GenAI in an educational context. Given the findings, future research will focus on a more detailed analysis, being carried out on educational levels (pre-university versus university) to identify possible differences in perceptions, usage patterns and educational impact. In addition, the study did not conduct an in-depth technical analysis of artificial intelligence tools, this aspect not being its main objective, but a good starting point for future writings. Moreover, a comparative evaluation of different types of AI tools could be conducted, in order to better understand their efficiency in various educational contexts.

Finally, an important direction to consider for future research is to evaluate the effectiveness of institutional policies and regulations regarding the use of AI, as well as their impact on user behavior, their responsibility and the overall quality of the entire educational process.

Acknowledgement

This paper was co-financed by The Bucharest University of Economic Studies during the PhD program.

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Appendix

Survey questions:

Section 0 - Research Purpose and Ethics

Section 1 – Respondent's Background (Socio-Professional Profile)

1. What is your primary role in education?
2. Which field do you work/study in?
3. How would you assess your level of proficiency in using artificial intelligence technologies in the educational context?
4. Have you ever used a Generative AI tool in your educational activities?

Impact of Generative AI on Teaching and Learning (Section 2 & 3)

Section 2 – Section for Learners / Students

1. Please select your age group:
2. For which educational activities do you use Generative AI?
3. How useful is AI in your learning process? (Likert scale 1-5)
4. Rate your agreement with the following statements (Likert scale 1-5):
 - AI helps me understand content faster.
 - AI makes my learning more efficient.
 - AI improves my independence in learning.
 - AI reduces time spent searching for information.
 - AI may positively affect my motivation or effort.
5. What challenges have you encountered in your learning and how has AI helped you overcome them?

Section 3 – Section for Teachers / Educators

1. How many years of teaching experience do you have?
2. In which activities do you use Generative AI?
3. How does Generative AI impact your teaching process?
4. What are the main challenges in using AI in teaching?
5. Please indicate your agreement with the following statements (Likert scale 1-5):
 - AI reduces repetitive tasks.
 - AI improves the quality of teaching materials.
 - AI facilitates personalized learning.
 - AI increases the risk of plagiarism or academic fraud.
 - AI complicates authentic student assessment.
6. Do you think training on using AI in teaching would be useful?
If yes, what type of training would be most useful for you?

Section 4– Generative AI Tools Used (Comparative Technology Analysis)

1. What word/words come to mind when you think of Generative AI in education?
2. Which Generative AI tools have you used in your educational activities?
3. Please list any other AI tools you use in your educational activities.
4. Have you observed any significant differences in the performance of Large Language Models (e.g., Gemini vs. GPT-4 or GPT-4 vs. Claude AI) when using them in STEM-related tasks? If so, what were these differences that you noticed?

Section 5 - Prospective, Patterns and Emerging Trends in AI on Short, Medium and Long Term

1. Which short-term trends do you expect to dominate education?
2. Which medium-term trends will influence education?
3. Which long-term trends may transform education?
4. Which trend do you think has the greatest potential to improve education?
5. Which trend worries you the most and why?
6. What trends concern you and why do you consider them worrying?
7. What actions do you consider should be taken in order to successfully manage these trends?