Italian Journal of Educational Technology
ISSN 2532-4632 (print) – ISSN 2532-7720 (online)
Accepted Manuscript Online
DOI: 10.17471/2499-4324/1459
https://ijet.itd.cnr.it

Framing Generative Artificial Intelligence through metaphors: Insights from Italian university students

Interpretare l'Intelligenza Artificiale Generativa attraverso le metafore: prospettive degli studenti universitari italiani

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HOW TO CITE Iannella, A., Sansone, N., & Bortolotti, I. (2026). Framing Generative Artificial Intelligence through metaphors: Insights from Italian university students. *Italian Journal of Educational Technology*. Accepted Manuscript Online. https://doi.org/10.17471/2499-4324/1459

ABSTRACT This study investigates how Italian university students metaphorically represent Generative Artificial Intelligence (GAI) and whether such representations show potential associations with gender, age, field of study and prior GAI knowledge. Data were collected through a cross-sectional online survey of 296 students. The analysis followed a hybrid Framework Method, combining inductive development of a category system, deductive application with single-label assignment, and double coding with assessment of intercoder reliability. Bivariate patterns were examined using chi-square tests and evaluated under Benjamini–Hochberg procedure for false discovery rate control (q = 0.05). Results revealed a compact repertoire of metaphor families. Tool/assistant framings predominated, followed by partner/coach and agent/autonomy framings; risk/control and ethics/governance framings were less frequent yet salient. Students' metaphors highlight available representational resources and pragmatic expectations about GAI, offering insights for Artificial Intelligence (AI) literacy activities focused on understanding, agency, and control. Limitations include explicit elicitation, single-label coding, and the use of a convenience sample. Future research should test multi-label coding schemes and analyse conversational interaction.

KEYWORDS Generative Artificial Intelligence; Metaphors; University Students; Technology Perception.

SOMMARIO Lo studio indaga come gli studenti universitari italiani percepiscono sul piano metaforico l'Intelligenza Artificiale (IA) Generativa e se le loro rappresentazioni sono associate al genere, all'età, all'area di studi e a eventuali competenze pregresse sul tema. I dati sono stati raccolti online tramite un questionario a carattere cross-sectional che ha coinvolto 296 studenti. L'analisi ha seguito il metodo Framework in versione ibrida, combinando sviluppo induttivo di un sistema di categorie, applicazione deduttiva con codifica a etichetta singola e doppia codifica con valutazione dell'affidabilità tra codificatori. Le associazioni bivariate sono state esaminate con test chi-quadrato e valutate tramite controllo del tasso di false scoperte con procedura Benjamini–Hochberg (q = 0.05). I risultati hanno evidenziato un repertorio compatto di famiglie metaforiche: predominano le cornici strumento/assistente, seguite da quelle partner/coach e agente/autonomia; le cornici rischio/controllo ed etica/governance, meno frequenti, risultano comunque rilevanti. Le metafore scelte dagli studenti rivelano risorse rappresentazionali e aspettative pragmatiche nei confronti dell'IA Generativa, offrendo spunti utili per attività di alfabetizzazione centrate sulla comprensione critica, l'agentività e il controllo. Tra i limiti si segnalano l'elicitazione esplicita, la codifica a etichetta singola e l'uso di un campione di convenienza. Ricerche future potrebbero testare schemi di codifica multi-etichetta e analizzare le interazioni conversazionali.

PAROLE CHIAVE Intelligenza Artificiale Generativa; Metafore; Studenti Universitari; Percezione della Tecnologia.

1. Introduction

Technological innovations in education often polarize public opinion (European Commission, 2021). With the launch of ChatGPT in November 2022 and the proliferation of similar tools, this polarization has become especially pronounced in the field of Generative Artificial Intelligence (GAI)[1]. On one side, proponents laud GAI for its transformative potential in various sectors, including education, healthcare, and creative industries. On the other side, critics raise concerns about ethical implications, job displacement, and the potential for misuse. Rather than giving in to the temptation to take sides, a balanced approach is needed, emphasizing an awareness of both its opportunities and risks. It is imperative to navigate this multifaceted domain with informed perspectives (Bender et al., 2021; Floridi et al., 2021; Miao & Shiohira, 2024).

Regardless of the application context, the primary shift that GAI introduces is the need for users to develop specific competencies to use it effectively and safely — from formulating prompts to evaluating outputs and their applicability — alongside solid domain knowledge. Ultimately, a proactive use of GAI systems demands a higher level of knowledge, metacognitive ability, and critical engagement from its users (Iannella, 2024; Marcus & Davis, 2019; Tankelevitch et al., 2024).

In addition to these competencies, individual attitudes toward technology play a key role in determining its acceptance and adoption. These attitudes emerge from a complex interplay of internal factors — such as self-efficacy, perceived usefulness, ease of use, and psychological motivations like enjoyment, trust, or curiosity — and external factors, including social norms, cultural representations, access to infrastructure, and opportunities for training or support. Moreover, they find expression in the metaphors individuals use to describe their experiences

[1] Literature uses several acronyms, including GAI, G-AI, GenAI, and generative AI.

Accepted Manuscript Online. DOI: 10.17471/2499-4324/1459

with technology. Metaphors act as windows into underlying cognitive frameworks, emotional responses, and social influences, offering a rich lens through which to interpret perceptions of technology.

In this study, we explore Italian university students' perceptions of GAI analyzing the metaphors they use to describe it. The aim is to uncover insights into their understanding of its role, potential, and limitations, and to examine if and how demographic or experiential factors, such as gender, age, cultural background, and educational experiences, shape or inform these perceptions. Metaphors are not decorative; they shape inference and decision making: reframing the same issue with different metaphors can steer divergent solutions (Thibodeau & Boroditsky, 2011). In parallel, GAI systems often elicit anthropomorphism and forms of co-intelligence that reallocate human and machine roles (Mollick, 2024). Reading students' metaphors through these lenses links language, expectations, and intended use.

2. Theoretical framework

Considering the rapid technological advancement and its impact on human matters, understanding how individuals embrace emerging technologies is increasingly important. Over the past three decades, numerous frameworks have been developed to identify the factors influencing this behaviour (Xue et al., 2024). Notable examples include the Technology Acceptance Model (TAM; Davis, 1986) and its subsequent extensions, the Theory of Planned Behaviour (TPB; Ajzen, 1991), and the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003).

When applying these frameworks to various social and educational contexts (Aurangzeb et al., 2024; Lawrence & Tar, 2018), two main dimensions emerged which may shape the attitude toward technology: an *internal*, individual dimension, and an *external*, social and cultural dimension.

Focusing on the internal, individual dimension, the factors influencing attitude - and consequently acceptance and adoption - can be grouped into *perceptual factors*, *psychological and motivational factors*, and *individuals' intrinsic traits*.

Studies based on the TAM model indicate that *perceived ease of use* of a technology fosters a positive attitude while also reinforcing its perceived usefulness. In turn, *perceived usefulness* contributes to a positive attitude and directly drives the intention to use the technology (Al-Hattami, 2023).

Perceived enjoyment, *perceived aesthetics*, and *perceived expressiveness* are recognized as key psychological and motivational factors that influence attitude and play a central role in the design of mobile technologies, applications, and social networks (Ernungtyas & Irwansyah, 2018).

Among individuals' intrinsic traits, *age* and *gender* have been highlighted as relevant factors (Venkatesh et al., 2003), along with *self-efficacy* (Bandura, 1986; 1997), which can be defined as an individual's judgment or confidence in their ability to effectively use the technology (Al-Hattami, 2023).

Moving to the external dimension, social and cultural representations play an important role in shaping technology adoption. The alignment of a technology with the values of a reference group can foster collective trust and encourage its integration into daily practices. Indeed, the extent to which individuals perceive that significant others expect or endorse their use of a given technology significantly influences perceived usefulness and the intention to adopt it (Al-Hattami, 2023). This influence extends to peer groups and, in instructional contexts, to

Accepted Manuscript Online. DOI: 10.17471/2499-4324/1459

relationships with educators or teachers. Teachers' attitudes strongly influence students' perceptions, not only through explicit curricular content but also through the implicit messages conveyed by the *hidden curriculum*. The hidden curriculum refers to the underlying ideologies, values, and expectations subtly communicated via a teacher's actions, behaviors, and interactions with students, even in the absence of direct instruction (Iannella & Pagani, 2022; Yan et al., 2024).

In addition to using validated scales, attitudes toward technology are investigated from a more qualitative-interpretative perspective by examining the metaphoric expressions individuals use in the view of a cognitive framework known as *conceptual metaphor* (Baldwin et al., 2017; Lakoff & Johnson, 1980). Derived from the Greek μεταφορά, a combination of the preposition μετα (*across*) and the verb φέρω (*to carry*), the term metaphor literally means "to carry across". It involves guiding someone by the hand to help them grasp meanings that often emerge from intimate, lived experiences. In their seminal work *Metaphors We Live By* (1980), Lakoff and Johnson argue that metaphors are fundamental to human thought and language, imbuing everyday expressions with imagery that shapes how we comprehend concepts. Metaphors reflect the way we conceptualize the world and our experiences within it, allowing us to articulate abstract ideas while preserving an idealistic outlook (Bullough, 1991; Schmitt, 2005). This is achieved by linking abstract notions to more tangible or familiar experiences, often through analogies (Saban et al., 2007). The analysis of a metaphor offers a window into understanding individuals' perceptions, encompassing both the internal and external dimensions previously discussed. Therefore, it enables inferences about a subject's implicit cognitive structures and the social and cultural frameworks that shape their experiences and beliefs (Schmitt, 2005; Yan et al., 2024).

It is notable that the interaction with technology, particularly in user interface design, is deeply rooted in metaphorical thinking, a practice that dates back to the early days of computing. Computer interfaces have adopted visual and functional elements of an office desk - including "files", "folders", and the "trash can" - to make the abstract digital environment more intuitive for users by bridging the familiar and the unfamiliar. Similarly, the "web" metaphor of the World Wide Web conveys an interconnected network, emphasizing the relational and interdependent nature of online information. Moreover, narratives about emerging technologies also permeate journalistic, academic, political, and corporate discourse, as illustrated in the case of AI and GAI. Consider, for instance, the notion of GAI as a companion, evident in the naming of Microsoft's Copilot, or the emphasis on adaptability and multiple perspectives suggested by Google's choice of Gemini, referring to the zodiac sign. As Esbrí-Blasco (2024) and Mitchell (2024) highlight, the prominent AI technologies are frequently described through various metaphors. Some view them as analogous to human minds or even alien-like entities capable of thought, reasoning, and intention. Others frame them as cultural tools akin to encyclopedias, mirrors reflecting human cognition, or mere probabilistic assemblers of text devoid of true understanding. These metaphors influence not only how users interact with such systems but also the direction of scientific research, legal decisions, and regulatory policies. Notably, Mitchell underscores that the use of anthropomorphic language, while facilitating natural interactions, risks creating unrealistic expectations and misconceptions about the nature and actual capabilities of these systems. This ambiguity raises ethical and methodological questions, highlighting the necessity for critical analysis of the assumptions underpinning AI discourse.

Studies on the metaphors employed by educational stakeholders to describe their perceptions of technology, whether in general terms or about its educational applications (e.g., *distance education*, *AI*, or *AI education*), are predominantly exploratory and advocate for a data-driven approach. Typically, these studies involve asking participants to complete written

Accepted Manuscript Online. DOI: 10.17471/2499-4324/1459

statements in questionnaires such as “Technology is like… because…” or, when the sample size is smaller, to participate in interviews (Jackson, 2016). The collected metaphors are then identified, validated, grouped in conceptual categories, and analysed (Saban et al., 2007; Schmitt, 2005). Using content and statistical analyses, these studies aim to evaluate whether technology is perceived positively or negatively and to identify patterns and variations based on factors such as role, gender, age, grade level, context, expertise, or frequency of technology use. Likely due to the specific nature of the samples in certain studies, significant differences in perception do not consistently emerge based on participants’ gender, grade level, frequency of technology use, or background information regarding technology (see *infra*). The goal of these studies is however to inform the design of educational tools and curricula that address misconceptions and promote a balanced understanding of technology.

Educational stakeholders tend to hold positive or balanced perceptions of technology, recognizing its dual nature as “both beneficial and harmful” (Gök & Erdoğan, 2010; Jackson, 2016; Karadeniz, 2012). This perspective aligns closely with the concept of challenge - a continuum of risks and benefits - which permeates institutional literature on the topic and underscores the importance of a critical, mindful, and proactive approach to technology use (Giannini, 2023; Miao & Shiohira, 2024). Observing pre-service teachers’ perceptions in Turkey, Gök and Erdoğan (2010) found that participants with medium to high scores exhibited a more neutral or balanced awareness of potential risks, whereas those with lower scores tended to emphasize the benefits and continuous change associated with technology. Pre-service teachers who learned to use technology in class or for presentations were more likely to adopt a perception of technology as positive in terms of necessity and facilitation, compared to those who acquired their skills from books, magazines, friends, or through self-directed learning. Conversely, individuals who learned to use technology independently displayed more diverse perceptions. Jackson (2016) conducted an organizational study based on Morgan’s (1980) framework, analysing teachers, administrators, and managers in a British college during the implementation of Information Systems/Information Technology (IS/IT). The study identified three dominant metaphorical themes. The first, “journey”, reflected uncertainty and adventure. The second, “military”, highlighted the hostility teachers expressed when new systems were introduced. The third, “bodily”, described symptoms and illness, revealing the problematic nature of IS/IT implementation practices.

Moving to Artificial Intelligence (AI) (Table 1), Demir and Güraksın (2022) investigated middle school students’ metaphorical conceptualizations, with results aligning with the perspectives discussed earlier. The study suggests that most students view AI positively and with high expectations, while also recognizing certain risks. They primarily associated AI with three main metaphorical categories: “humanistic”, “technology”, and “brain”. AI was thus linked to positive human traits or positioned in relation to humans. The “brain” metaphor represented the notion of AI as a highly capable entity: intelligent, creative, and a connected source of information with unlimited knowledge, capable of solving any problem. The “technology” category reflected the idea of AI as a concrete tool designed to perform specific tasks. This reveals a particular perspective: since machines possess higher computational capacity than humans, participants believed AI would surpass human intelligence and solve all problems. Among the negative perceptions, ideas of danger, threats, or concerns about AI taking over jobs were common, possibly influenced by media narratives. Focusing on the same target group in private Turkish[2] schools, Tartuk (2023) confirmed the prevalence of metaphors within

[2] Recent empirical work on AI metaphors in higher education has been published predominantly in non-Italian contexts, with a noticeable cluster of studies conducted in Turkey. We include this literature for two reasons: (i) the samples are comparable

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the "human/subject" category, emphasizing the view of AI as a tool or entity designed to replicate human intelligence. A notable number of participants also highlighted its technical and object-like nature, referencing more concrete features. Observing the perceptions of Turkish language prospective teachers, Savaşkan and Özer (2024) found that these teachers interpreted AI predominantly positively, viewing it as a "Reflector of Concrete Concepts", with human-related imagery playing a central role. Lim (2024) explored the perceptions of U.S. pre-service teachers regarding AI education for young children in terms of "education that allows young children to understand AI, form the right values, and express their thoughts and feelings freely through play while interacting with AI". Most participants held positive perspectives about AI education, identifying its potential as a tool for play and experiential learning and as a future essential. However, many felt unprepared to integrate AI into their lessons due to a lack of specific training in computer science. Some teachers emphasized the negative aspects, such as AI's dual nature and its complexity.

in age and digital background to our participants; (ii) the focus on representational processes (metaphor use) is largely transferable across similar higher education settings.

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Table 1. Metaphor Categories from Studies about AI and GAI in Educational Contexts.

Study	Target	Metaphors	Categories and Distribution
Demir and Güraksın (2022)	Middle School Students	339	Humanistic (30.5%); Technology (29.7%); Brain (16.2%); The Dilemma of Good and Evil (5.1%); Service (5.1%); Nature (4.2%); Smart (2.5%); Security (2.3%); Time (1.9%); Object (1.3%); Life (1.3%)
Tartuk (2023)	Middle School Students	51	Human/Subject (39.2%); Interesting/Other (25.5%); Technical/Object (21.6%); Nature-related (13.7%)
Savaşkan & Özer (2024)	Language Prospective Teachers	115	Reflector of Concrete Concepts (57.5%); Reflector of Abstract Concepts (30.1%); Tutorial/Guide/Engagement (7.1%); Reflector of Emotions (2.7%); Natural Phenomenon (2.7%)
Lim (2024)	Pre-service Early Childhood Teachers	137	Possibility of play and experience (33%); Future essentials (31%); Innovation and change (16.8%); Double-sided meaning (13.1%); Convenience (9.5%); Assistant teacher (8%); Complexity (5.8%)
Yan et al. (2024)	University Students	281	Humans (49.7%); Tool/Machine (29.2%); Resources (14.7%); Brain (2.7%); Food/Drink (2.3%); Medicine (1.3%)
An et al. (2024)	University Students	21	Tools (61.9%); Human (38.1%)

As of December 2024, research on students' perceptions of GAI through metaphors are limited, likely due to the recent introduction of this technology in educational contexts. Yan et al. (2024) investigated the perceptions of students from four universities in China, specifically English as a Foreign Language (EFL) learners, toward GAI in language learning. Their study revealed a predominant anthropomorphization of GAI, with strong correlations to emotional reliance and interpersonal dynamics. Students mostly held positive attitudes appreciating GAI's efficiency and support. However, some expressed critical concerns about over-reliance and ethical issues, particularly regarding the potential loss of critical thinking skills. An exploratory study with U.S. university students from three institutions conducted by An et al. (2024), most of whom were majoring in information science, confirmed both an anthropomorphic stance and a strong tendency to perceive ChatGPT through familiar technological analogies. When students described *what ChatGPT is*, the dominant framing was that of a tool, most frequently Google but also encyclopaedias or messaging systems — metaphors that anchored ChatGPT in everyday digital practices. In contrast, when explaining *how ChatGPT interacts with users*, participants more often relied on human-centered metaphors, portraying it as a friend, assistant, or conversational partner. The idea of comparing ChatGPT to familiar, everyday tools — and

Accepted Manuscript Online. DOI: 10.17471/2499-4324/1459

even equating its operations with real-time web searches — revealed persistent misconceptions about the system's actual functioning.

3. Methods

3.1. Research Objectives and Questions

The primary aim of this study is to explore university students' perceptions of GAI and to identify the factors that may have shaped or influenced these perceptions. Therefore, the research seeks to address the following questions:

- Research Question 1 (RQ1): *How do university students metaphorically represent Generative Artificial Intelligence?*
- Research Question 2 (RQ2): *To what extent do students' perceptions show patterns that might be tentatively related to factors such as educational experience, gender, age and previous GAI knowledge?*

3.2. Research Instrument

To address the study's research questions, the method adopted was the one proposed by similar studies (Saban et al., 2007; Schmitt, 2005; see 1). Data were collected using an anonymous semi-structured questionnaire[3] composed of multiple sections aimed at analysing various aspects of the relationship students have with GAI systems and, more broadly, with this technology. For the purposes of this research, we focus on the following sections:

1) *Background Information*, which gathered demographic and educational background details, including gender, age, university affiliation, and field of study.
2) *Knowledge of GAI*, which examined students' familiarity with GAI, exploring their general awareness, the use of specific systems (such as ChatGPT or Gemini) and prior training.
3) *Metaphorical Description, which* included an open-ended item asking students: "If you had to define Generative Artificial Intelligence using a metaphor, how would you describe it?".

The questionnaire was developed and administered using Google Forms, with responses collected over a period spanning from the first half of March 2024 to the second half of August 2024. Participation in the study was entirely voluntary, and no incentives were offered to students, in line with the anonymous nature of the survey. The sampling method was a convenience sampling approach, determined by the teaching affiliations of the authors of the study. Participants were recruited from

[3] English and Italian versions are available here: https://drive.google.com/drive/folders/1LKo9EoriCABcsJIoZl8Hr829L4w2WlzB

Accepted Manuscript Online. DOI: 10.17471/2499-4324/1459

universities where the researchers were actively involved in teaching during the last three years. While this method facilitated the collection of data across multiple institutions as it exploited their accessibility to the target population, it inherently limited the generalizability of the results. This is due to the non-random nature of the sample and the possibility of having included students who had already been exposed to the topic during one or more lectures.

3.3. Data analysis

Data were analysed using a mixed qualitative-quantitative approach, employing IBM SPSS and Microsoft Office Excel for statistical and data management purposes.

Data from Section 1 underwent descriptive statistical analysis, providing a clear overview of the main characteristics of the respondent group in relation to the research questions. Key categorical variables — including gender, age, university, and field of study — were systematically re-coded in SPSS by assigning numerical labels to each category to enable more efficient statistical processing. In particular, the university variable — originally coded by institution name — was re-coded into a dichotomous format distinguishing between online and traditional universities, allowing for clearer and more meaningful comparisons. The same methodological procedure was applied to the items in Section 2 to develop a more precise understanding of respondents' engagement with GAI[4]. All categorical data were processed in SPSS using the same systematic coding protocol adopted for Section 1, ensuring methodological consistency throughout the study.

Open-ended responses were subjected to content analysis, allowing for a qualitative exploration of participants' perspectives (see 3.3.1). To investigate potential relationships among the variables, the following chi-square tests were conducted using IBM SPSS (Table 2).

Table 2. Statistical Analysis Plan.

Test	Explored Association
Chi-square	*Gender* (dichotomous variable), *Generation* (4-level variable), *Awareness* (dichotomous variable), *Training* (dichotomous variable),

[4] The original item on awareness asked respondents to select one of the following options: "I know what it is", "I know what it is and have used it", "I don't know what it is but have heard of it", and "I've never heard of it". For analytical purposes, these responses were consolidated into two broader categories: Awareness and No Awareness, to ensure greater clarity and manageability in the statistical analysis.
The item on training asked respondents to indicate whether they had participated in specific types of learning experiences by answering "Yes" or "No" to each of the following options: "I took a specific course", "I attended a specific lesson", and "I self-learned". For analysis, responses were grouped into two main categories: *Training* and *No Training*. A third category, *No Response*, was included to account for participants who did not respond to any of the training-related items.

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	University (dichotomous variable), *Field of Study* (3-level variable) x *Metaphor World* (6-level variable).
	Gender (dichotomous variable), *Generation* (4-level variable), *Awareness* (dichotomous variable), *Training* (dichotomous variable), *University* (dichotomous variable), *Field of Study* (3-level variable) x *Metaphor Functionalism* (dichotomous variable)
	Gender (dichotomous variable), *Generation* (4-level variable), *Awareness* (dichotomous variable), *Training* (dichotomous variable), *University* (dichotomous variable), *Field of study* (3-level variable) x *Critical Judgment* (3-level variable).

The chosen statistical methods provided a robust framework for exploring and identifying meaningful relationships between the study variables, addressing both categorical and continuous data types.

3.3.1. Metaphor domains: system of analysis

In order to analyse the metaphors provided by respondents, we adopted a hybrid analytical approach inspired by the Framework Method (Gale et al., 2013), which is particularly suited to studies with predefined research questions but also allows for inductive insights. The process combined bottom-up coding with a structured top-down categorization, enabling both data-driven theme generation and alignment with theoretical constructs. In the initial phase, a subset of responses was reviewed inductively to identify recurring metaphorical patterns. This exploratory step informed the creation of preliminary categories. Subsequently, these categories were iteratively refined and applied across the dataset using a more structured, deductive coding phase. In this second phase, two independent coders assigned each metaphor to one of the finalized categories, with interrater disagreements resolved by a third researcher. While the coding drew initial inspiration from Grounded Theory principles (Glaser & Strauss, 1967), especially in the open and axial coding stages, the analytical process more accurately reflects the principles of the Framework Method, ensuring both analytical depth and systematic comparison across cases:

1) *Explicit functionalism*, which pertains to whether the metaphor includes explicit references to the function of GAI. The analysis distinguishes between metaphors that highlight specific functionalities ("GAI is like a lighthouse in the night, shining a path

Accepted Manuscript Online. DOI: 10.17471/2499-4324/1459

with knowledge and guiding curiosity through deep waters") of the tool and those that do not ("GAI is like the genie of the lamp").

2) *Critical Judgment*, which reflects the presence of a positive ("GAI is a skilled tailor that shortens distances and crafts perfect outfits for every occasion"), negative ("The magic mirror in Snow White: it knows everything, it knows what the Queen wants, but it cannot help her because it only reflects those who look into it, without reflecting on its own"), or balanced judgment ("It's a compass that can guide and point to the right path... but it's up to us to walk the journey to reach the goal") about GAI, inferred from the respondent's choice of words.
3) *Theme of the Metaphor*, which refers to the overarching category, here termed "world", that encapsulates the imagery, associations, and analogies conveyed through students' metaphors.

The coding process of the metaphors followed a structured methodology combining bottom-up and top-down approaches to ensure rigor and reliability. The initial stage involved analysing a preliminary sample of responses to identify recurring themes and patterns. As shown in previous similar works (see 2), this bottom-up process was data-driven, with the researchers extracting potential categories directly from the metaphors provided by participants. Through iterative cycles of application and refinement, the categories were progressively adjusted to enhance clarity and mutual exclusivity. During these cycles, residual categories - those containing responses that were too varied or inconsistent to form a coherent group - were excluded. This process culminated in the identification of a set of five categories (Table 3).

We adopted a single-label assignment per response to preserve mutual exclusivity and enable clear counts by metaphor family. We acknowledge that some statements could warrant multi-label coding; we document borderline cases in the codebook and revisit this choice in Limitations. Although this single-assignment approach supported a more systematic classification, it is acknowledged that some metaphorical responses may resonate with multiple domains. Future studies might adopt a multi-coding strategy to better account for such conceptual overlap and the multidimensional nature of metaphorical representations.

Table 3. Metaphor Worlds: Description and Examples.

World	Description	Examples
Human World	people and professions, human behaviors	ChatGPT is like a professor who explains anything in a simple way
Natural World	natural elements	GAI is like a lightning bolt (the answer to the question comes quickly, but it's not in-depth)

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World of Objects	objects, tools, and concrete things	GAI is like Nutella, nice and sweet, as long as you don't overdo it
World of Ideas	abstract thoughts and images	Artificial intelligence is an opportunity
Sacred-Fantastic-Mythical World	sacred, fairy-tale, or mythological worlds	ChatGPT for me is like the Oracle of Delphi
Not Classifiable	sayings, statements	Carpe diem

An initial inductive review informed the coding framework; once finalized, two coders applied it deductively. A random subset of responses was double-coded. Discrepancies were resolved by discussion; a third adjudicator reviewed any unresolved cases. The remaining corpus was split and coded independently with periodic consensus checks. This hybrid procedure ensured consistent category assignment and supports the validity and reliability of the analysis.

3.4. Participants: demographics factors

The study involved a total of 296 Italian university students from various institutions across the country. Among them, 175 were enrolled in online degree programs, while 121 attended traditional, in-person courses (Table 4).

Table 4. Distribution of Participants by University.

University Typology	N (%)
Telematic University	175 (59.1%)
Traditional University	121 (40.9%)
Total	296 (100%)

The sample was predominantly female, with 205 women (69.26%) and 91 men (30.74%). The participants had an average age of 36 years (M = 36.13, SD = 12.68).

Based on the year of birth provided by respondents, it was possible to classify participants into generational cohorts (Mannheim, 1927/1952), a categorization considered particularly valuable for developing interpretative hypotheses (Zucker et al., 2002). These cohorts were defined as mutually exclusive, with each respondent assigned to a single generational group based on their year of birth. The identified cohorts include Baby Boomers (1946–1964), Generation X (1965–1980), Millennials (1981–1996), and Generation Z (1997–2012). As shown in Table 5, Generation Z represents the largest share of the sample (*n* = 117, 39.53%), followed by Millennials (*n* = 89, 30.07%) and Generation X (*n* = 79, 26.69%). Baby Boomers were only marginally represented in the dataset.

Table 5. Distribution of Participants by Generation.

Generation	N (%)

Accepted Manuscript Online. DOI: 10.17471/2499-4324/1459

Baby boomers	11 (3.72%)
Generation X	79 (26.69%)
Millennials	89 (30.07%)
Generation Z	117 (39.53%)
Total	296 (100%)

3.5. Participants: previous GAI knowledge

Most respondents (*n* = 254, 85.81%) reported being familiar with GAI. This self-reported familiarity likely reflects varying levels of experience, from general awareness to more practical engagement. Among these, in fact, 81.08% (*n* = 240) indicated having received training in GAI, either through self-directed learning or participation in structured or semi-structured courses. In contrast, 7.43% (*n* = 22) reported not having received any form of training. A further 11.48% (*n* = 34) did not provide information regarding their training experience with GAI (Figure 1).

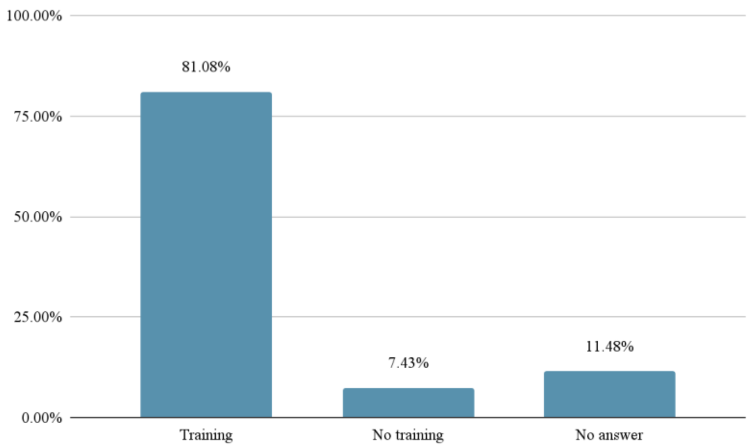

Figure 1. Students' training experience with GAI.

4. Results

4.1 Research Question 1

To address the first research question, "*How do university students metaphorically represent Generative Artificial Intelligence?*", we analysed the metaphors chosen by students to describe their perception of GAI.

The analysis initially focused on the presence of an explicitly stated function of GAI. Nevertheless, most respondents (*n* = 193, 65.20%) did not include a functional element in their

Accepted Manuscript Online. DOI: 10.17471/2499-4324/1459

responses, while 34.80% (n = 103) incorporated this aspect into their metaphors[5]. As expected given the concreteness of the source domains, functionalism was most frequently observed in metaphors describing tangible or “concrete” elements (“Generative Artificial Intelligence is like a car; it takes you where you want to go with minimal effort”), whereas metaphors referring to abstract concepts or ideas were less likely to incorporate explicit functionalism (“A valuable enhancement”).

With respect to the critical judgment expressed in the metaphors, as shown in Table 6, a significant portion of the metaphors lacked an explicit critical judgment (n = 129, 43.58%)[6].

Table 6. Critical Judgment of Metaphors.

Critical Judgment	f(f%)
No critical judgment	129 (43.58%)
Balanced	65 (21.96%)
Negative	55 (18.58%)
Positive	47 (15.88%)
Total	296 (100%)

However, 21.96% of respondents (n = 65) conveyed a balanced judgment, emphasizing that the value of GAI is not inherently positive or negative but depends on its use (“GAI is like a knife: if used the right way, it can help you; otherwise, it can harm you”). Metaphors expressing a negative judgment (n = 55, 18.58%) often focused on the risks of relying on GAI, such as its inability to interpret or present information accurately or comprehensively: “An omniscient God who only tells you the little bit it wants”. Conversely, metaphors with a positive judgment (n = 47, 15.88%) highlighted the benefits of GAI: “GAI is like a friend who is super informed about everything”; “A lighthouse in the night, shining a path with knowledge and guiding curiosity through deep waters”.

Moving on to the more strictly thematic analysis[7] (Table 7), the analysis reveals that most respondents employed metaphors from the “World of Objects” to describe GAI (n = 81, 27.36%; e.g., “GAI is like a trampoline”, “GAI is like a fountain”).

[5] Inter-rater reliability for the coding of explicit functionalism was assessed using Cohen’s Kappa coefficient, which yielded a value of 0.978. The standard error of Kappa was 0.013, with a 95% confidence interval ranging from 0.953 to 1.000.

[6] Inter-rater reliability for coding critical judgment was assessed using Cohen’s Kappa, which yielded a value of 0.918. The standard error of Kappa was 0.019, with a 95% confidence interval ranging from 0.880 to 0.955.

[7] The reliability of the thematic coding was assessed using Cohen’s Kappa coefficient, which yielded a value of 0.975. The standard error of Kappa was 0.010, with a 95% confidence interval ranging from 0.955 to 0.995.

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Table 7. Metaphor Worlds.

World	*f*(*f*%)
World of Objects	81 (27.36%)
Human World	65 (21.96%)
Sacred-Fantastic-Mythical World	39 (13.18%)
Natural World	38 (12.84%)
World of Ideas	30 (10.14%)
Not Classifiable	43 (14.53%)
Total	296 (100%)

The "World of Objects" was immediately followed by metaphors originating from the human world (*n* = 65, 21.96%; e.g., "GAI is like a tutor", "GAI is like a sage"). Metaphors drawn from the "Sacred-Fantastic-Mythical World" (*n* = 39, 13.18%; e.g., "GAI is like a two-faced monster", "GAI is like Jiminy Cricket") and the "Natural World" (*n* = 38, 12.84%; e.g., "GAI is like a shadow", "GAI is like a light"), instead, were less frequent but still notable. Metaphors belonging to the "World of Ideas" were the least commonly used (*n* = 30, 10.14%; e.g., "GAI is like an opportunity", "GAI is like a shortcut").

Remarkably, a significant subset of respondents did not use metaphors, rather conveyed their perceptions through maxims (e.g., "Carpe diem") or statements (e.g., "Nothing comes to mind. I just know it will make it even harder to distinguish between real and unreal, and that humans do not evolve or are intelligent enough to handle such a weapon") (*n* = 43, 14.53%).

4.2 Research Question 2

With respect to RQ2 "*To what extent do students' perceptions show patterns that might be tentatively related to gender, age, educational experience, or previous GAI knowledge?*", a chi-square test was conducted to examine potential relationships between background variables (gender, generational cohort, university, and field of study) and GAI-knowledge variables (awareness and training) with the three analytical dimensions of metaphors (functionalism, critique, and theme). After controlling for multiple comparisons using the Benjamini–Hochberg procedure for false discovery rate control (q = 0.05), no associations remain statistically significant. Nominal differences are treated as weak, non-conclusive signals.

According to the results of the chi-square test, it can be inferred that none of the independent variables considered in the analyses appear to influence functionalism (Table 8), critical judgment (Table 9), or the themes (Table 10) reported in the metaphors analyzed.

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Table 8. Chi-square Results for Metaphor Functionalism.

Independent Variables	X^2	*df*	*p*
Gender	.033	1	.856
Generational cohort	2.925	3	.403
University	2.296	1	.130
Field of study	1.553	2	.460
Awareness	11.634	5	.040
Training	.241	1	.624

Table 9. Chi-square Results for Critical Judgment.

Independent Variables	X^2	*df*	*p*
Gender	3.365	3	.339
Generational cohort	8.699	9	.466
University	8.104	3	.044
Field of study	6.083	6	.414
Awareness	1.052	3	.789
Training	6.658	3	.084

Table 10. Chi-square Results for Metaphor World.

Independent Variables	X^2	*df*	*p*
Gender	2.519	5	.774
Generational cohort	16.658	15	.340
University	2.277	5	.810
Field of study	11.654	10	.309
Awareness	11.634	5	.040
Training	5.924	5	.314

5. Discussion

A key finding of this study is the polarization of metaphorical judgments, ranging from highly empowering to strongly critical images. This indicates the diverse emotional and

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cognitive framings that students associate with GAI. Positive metaphors, such as "a lighthouse in the night", align with the idea of GAI as an empowering tool. Conversely, negative metaphors like "an omniscient god who only tells you the little bit it wants" reflect concerns about power dynamics, ethical opacity, and the risks of over-reliance. This polarization may also be shaped by external sociocultural narratives, including media representations of AI as both a revolutionary force and a potential existential threat (Mitchell, 2024). These findings reinforce the importance of fostering critical AI literacy to help students navigate such conflicting representations.

Students' perceptions of GAI also align with the broader literature in portraying technology as a double-edged sword (Giannini, 2023; Miao & Shiohira, 2024). The recurrence of balanced metaphors (e.g., "GAI is like a knife: if used the right way, it can help you; otherwise, it can harm you") reflects this duality and suggests the presence of a reflective stance. However, we are cautious not to overstate this as a sign of deep or nuanced understanding; rather, it illustrates how learners are beginning to grapple with both the opportunities and risks of GAI through familiar frames.

The predominance of metaphors derived from the "World of Objects" (27.36%), followed by the "Human World" (21.96%), suggests a pragmatic and instrumental view of GAI, in which it is primarily perceived as a tool for solving problems or supporting individual needs. While functionalism was not a dominant pattern overall, we note that half of all functional metaphors fell within the "World of Objects", and 63% of metaphors in that world were functional. These patterns align with TAM-related constructs such as perceived usefulness (Davis, 1986), and with findings from Demir and Güraksın (2022), Savaşkan & Özer (2024), and An et al. (2024). However, they diverge from studies where anthropomorphic metaphors dominate (Tartuk, 2023; Yan et al., 2024).

The observed metaphor patterns are consistent with evidence that metaphors guide reasoning (Thibodeau & Boroditsky, 2011): "tool" versus "agent" framings align with different expectations of control, accountability, and risk. The tendency to attribute intentionality to GAI resonates with emerging accounts of co-intelligence in educational and organizational practice (Mollick, 2024). In line with Mitchell's (2024) caution regarding the risks of anthropomorphizing AI, the relatively limited presence of human-like metaphors in our study may reflect a more grounded and critical framing of GAI. This may also signal a normalization of AI tools in academic and professional environments, where the focus is more on instrumental value than personification.

At the same time, the predominance of object-based metaphors invites reflection on possible blind spots: pragmatic framings, while useful, might obscure awareness of ethical dilemmas, sociocultural impacts, or systemic biases embedded in GAI systems. Additionally, while our coding system required assigning each metaphor to a single thematic category to preserve analytical clarity, we recognize that some responses, such as the one referring to a "weapon", may carry multiple metaphorical dimensions and could reasonably fit more than one category. For this exploratory study, we adopted mutually exclusive coding, but future research could implement multi-label strategies to better capture this interpretive richness.

We also recognize that borderline cases—such as emotionally charged statements without explicit analogical structure—raise classification challenges. Following Lakoff and Johnson (1980), we defined metaphors as involving a conceptual mapping between two domains (e.g., "GAI is a double-edged sword"). Statements expressing opinions or predictions without this analogical framing were not coded as metaphors. These criteria are clarified in the Methods section, and we reflect here on their limitations.

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Metaphors were explicitly elicited by the prompt. This design can prime figurative language and filter out spontaneous framings. The findings therefore reflect available metaphorical repertoires under elicitation, not the full range of in-the-wild discourse. While this approach has value in educational research (Schmitt, 2005; Saban et al., 2007), it may lead to more reflective or constructed expressions, rather than capturing embedded metaphors that shape spontaneous reasoning. Future studies may integrate more naturalistic or discourse-based methods to complement this design.

The associations do not survive Benjamini–Hochberg procedure for false discovery rate control. Nominal trends suggest exploratory leads that warrant larger samples and confirmatory designs. This may suggest a degree of convergence in how students represent GAI, possibly influenced by shared media narratives and cultural framings. Alternatively, the finding may reflect a limitation of our sample, which was composed predominantly of students from humanities and social sciences (90.88%). These students may be more inclined to pragmatic or functional interpretations of GAI, given their exposure to sociocultural and critical approaches rather than technical perspectives.

While we recognize the limitations of our sample and the absence of statistically significant correlations, we chose to retain RQ2 in the main body of the paper for two reasons. First, negative results are meaningful in exploratory research: the lack of significant associations may point to a convergence in students' metaphorical representations of GAI across demographic and experiential differences, which is a relevant finding. Second, these results provide a useful foundation for generating hypotheses and designing future studies with more diverse, stratified samples, as discussed in the final section.

6. Conclusions and Future Implications

This study provides insights into how Italian university students represent GAI when prompted to express their perceptions through metaphor. The most salient finding is the polarization of metaphorical judgments, ranging from highly empowering to strongly critical images — an indication of the diverse emotional and cognitive framings students associate with GAI.

While a predominance of metaphors from the "World of Objects" and "Human World" suggests a pragmatic and functional orientation, caution is warranted in interpreting this as a fully nuanced understanding. Rather, the metaphors reveal a spectrum of conceptual framings that warrant further exploration.

The study also reflects methodological limitations, including the disciplinary bias of the sample and the use of self-reported and elicited data. The single-label scheme simplifies analysis but may under-represent hybrid metaphors. Future studies should test multi-label approaches or hierarchical coding to capture overlap. Notably, while metaphor analysis offers a valuable lens for exploring conceptualizations of technology, the explicit request to produce metaphors may have shaped the form and depth of participants' responses. Future research could integrate the analysis of conversational interactions.

From an educational standpoint, the findings underscore the importance of integrating AI literacy into university curricula, by following some practical recommendations aimed at promoting a proactive approach in using GAI systems for supporting tasks:

1) AI literacy modules should be introduced into university programs, combining technical knowledge with discussions on ethical and societal impacts to encourage critical engagement with GAI.

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2) Activities such as case studies, reflective writing, and collaborative discussions should be implemented to help students critically analyse their interactions with GAI.
3) Universities should adopt frameworks that guide students in the conscious evaluation of GAI systems, fostering their ability to assess outputs and ethical dimensions comprehensively.

Future research should broaden the scope of investigation by utilizing a non-voluntary sample or incorporating a more diverse participant pool, particularly students from STEM and health sciences disciplines. Longitudinal studies could explore how students' perceptions of GAI evolve as they gain more exposure and training in these systems. Additionally, expanding the analysis to cross-cultural contexts would provide a comparative perspective on how cultural narratives shape metaphorical representations of GAI, further enriching our understanding of these perceptions.

7. Author contributions

All authors participated in conducting the study and conceptualizing the article. Specifically, A. Iannella was responsible for writing the Introduction, Theoretical Framework, Discussion and designing the instrument; N. Sansone authored the Method, Results and Conclusions sections; and I. Bortolotti handled the data analysis and editorial revision. All authors contributed to enriching each other's sections.

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