AI-DRIVEN THESIS DEFENCE: ENHANCING LEARNING AND ENGAGEMENT THROUGH CHATBOT INTERACTION

DISCUSSIONE DI TESI GUIDATA DALL'INTELLIGENZA ARTIFICIALE: POTENZIARE L'APPRENDIMENTO E IL COINVOLGIMENTO ATTRAVERSO L'INTERAZIONE CON UN CHATBOT

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Double Blind Peer Review

Citation
Di Domenico, M., Amendola, G., Sozio, A., & Di Tore, P.A. (2025). AI-driven thesis defence: enhancing learning and engagement through chatbot interaction. *Giornale italiano di educazione alla salute, sport e didattica inclusiva*, 9(1).

Doi:
https://doi.org/10.32043/gsd.v9i1.1479

gsdjournal.it
ISSN: 2532-3296
ISBN: 978-88-6022-509-2

ABSTRACT
The integration of AI is reshaping educational methods by enabling personalized learning, real-time feedback, and the promotion of active engagement (Luckin et al., 2016). This study explores a case that merges constructivist and experiential learning principles with innovative technologies, leading to an AI-driven approach that fosters active learning and knowledge building (Bruner, 1996; Vygotsky, 1978; Papert, 1980). The case study under analysis concerns a thesis defence conducted by a chatbot trained by the student herself.

L'integrazione dell'IA sta ridefinendo i metodi educativi, permettendo un apprendimento personalizzato, feedback in tempo reale e la promozione del coinvolgimento attivo (Luckin et al., 2016). Questo studio analizza un caso che unisce i principi dell'apprendimento costruttivista ed esperienziale con tecnologie innovative, dando vita a un approccio formativo basato sull'IA che favorisce l'apprendimento attivo e la costruzione della conoscenza (Bruner, 1996; Vygotsky, 1978; Papert, 1980). Il caso esaminato riguarda una discussione di tesi condotta da un chatbot addestrato dalla stessa studentessa.

KEYWORDS
Artificial Intelligence, Higher education, Thesis defence, Chatbot, Narrative intelligence.

Intelligenza Artificiale, Istruzione superiore, Difesa di tesi, Chatbot, Intelligenza narrativa

Received 30/04/2025
Accepted 29/05/2025
Published 20/06/2025

Introduction

We live in an era in which digital technologies filter and transform the information we receive and transmit, acting as intermediaries in an informational environment that Floridi defines as the infosphere. These technologies actively contribute to shaping the way we perceive and interact with the world (Floridi, 2014).

Within this context of informational transformation, it becomes crucial to adopt educational approaches that ensure accessibility, flexibility, and active student engagement. The Universal Design for Learning (UDL) framework (CAST, 2018; Meyer, Rose, & Gordon, 2014) offers a vital theoretical and practical foundation for rethinking education within the infosphere. It promotes educational pathways that embrace diverse ways of perceiving, expressing, and engaging with cognitive processes. This perspective aligns with the need to enhance citizens' digital competencies, enabling them to critically navigate complex environments while also fostering social inclusion and active participation in the information society (European Commission, 2020).

The emergence of Large Language Models (LLMs) has significantly impacted human–machine interaction, enabling communication with conversational agents that possess advanced narrative and dialogical capabilities, tools capable of stimulating reflection, learning, and metacognition (Brown et al., 2020).

This paper presents a case study in which a student, supported by her thesis advisor, Professor Pio Alfredo Di Tore (Media Education), designed and developed a narrative chatbot to interact with the examination board during the defence of her master's thesis in Pedagogical Sciences. The event took place on April 14 at the University of Cassino and Southern Lazio, receiving considerable media attention from prominent national and international outlets, thereby sparking broader discussion around the innovative use of Artificial Intelligence (AI) in educational contexts.

The chatbot, named Veronica after the student, appears through a digital avatar that faithfully replicates her features, obtained via a 3D facial scan. The avatar's voice was also customized to match her original tone and intonation. This design choice aimed to reinforce the sense of social presence (Gunawardena, 1995; Lowenthal, 2010) and support narrative identification (Bruner, 1991), allowing the student to recognize herself in the virtual alter ego and to experience the interaction as authentically dialogical.

Originating as an integral part of the thesis titled “Educating Artificial Intelligence, Educating to Artificial Intelligence: Mitigating Biases”, the project transcended its technical scope to represent a potential paradigm shift in education. Its pedagogical aim was to explore how interaction with an artificial agent could foster active, reflective, and critical learning processes. Aligned with the principles of Universal Design for Learning, the project exemplifies innovative pedagogy that values flexible modes of interaction, supports cognitive diversity, and promotes the active inclusion of students in educational processes.

Following the constructivist perspectives of Bruner (1990) and Papert (1980), learning is understood as an active process of meaning-making, where the student becomes both protagonist and co-author of her own educational journey. The use of the chatbot aligns with this view, providing a dialogical and reflective space that goes beyond simple information retrieval.

This contribution aims to interweave theoretical reflection with practical experimentation, exploring how narrative interaction with an artificial agent can become a critical and reflective learning environment capable of significantly transforming educational models.

1. Theoretical framework: Cognitive technologies and learning agency

In today’s complex historical context, education is increasingly shaped by digital technologies that deeply influence how we construct and share knowledge. Data, algorithms, and users themselves contribute to forming a cognitive and informational ecosystem, one that marks a significant shift in our self-understanding and brings with it substantial opportunities alongside complex ethical and epistemological challenges (Floridi, 2014). In such a scenario, it becomes essential to adopt a digital literacy approach that goes beyond the mere acquisition of technical skills. As Martin (2008) highlights, digital literacy also encompasses the ability to critically evaluate content, actively participate in public discourse, and understand the ethical and social implications of digital technologies.

Within the broader landscape of educational innovation, Artificial Intelligence (AI) is emerging as a transformative element, with implications that extend well beyond simple task automation. Luckin et al. (2016) argue that AI in education can evolve from being a passive provider of information to an active facilitator of student learning processes. This transition positions AI not just as a data presenter but as a

strategic tool to promote critical thinking, self-assessment, and autonomous re-elaboration of content. In line with this perspective, AI becomes a means of fostering deeper, more meaningful learning, where students are encouraged to develop critical thinking and problem-solving skills rather than passively absorb information.

This vision aligns with the paradigm of Algorithmic Pedagogy proposed by Rivoltella and Panciroli (2020), which asserts that AI does not merely automate educational tasks but reinterprets the very conditions of teaching. AI functions as an epistemic device within a new cognitive ecology, requiring educational practice to adopt a reflective, intentional, and critical stance toward the algorithmic logics that structure experience.

In this light, the educational use of AI finds solid grounding in the social constructivism of Vygotsky (1978), who emphasized the interpersonal construction of meaning, and in Papert's constructionism (1980), which holds that learning is more effective when individuals are engaged in creating meaningful artifacts rather than passively listening.

In the specific case study, the student's continuous interaction with the narrative chatbot Veronica enabled meaning-making processes akin to dialogic negotiation, while the design and training of the chatbot itself represented a cognitive artifact actively constructed in accordance with constructionist principles.

Simultaneously, Jerome Bruner emphasized the role of narrative as a cognitive structure capable of organizing information into causal and temporal sequences, thereby enhancing memorability and facilitating transfer to new contexts (Bruner, 1991). The work of McDrury & Alterio (2003) and Green (2004) further demonstrated that narrative learning fosters deeper conceptual elaboration, increasing both engagement and the ability to apply knowledge in novel situations. Within this perspective, the narrative chatbot Veronica, designed to support the thesis defence, served as a tool to reorganize complex knowledge through narrative pathways, thus fostering active meaning construction and transfer to new communicative contexts.

Furthermore, the affective dimension emerged as a critical factor in learning processes. Fredrickson (2001) highlighted that emotionally positive environments enhance cognitive flexibility, intrinsic motivation, and creative thinking, thereby promoting more effective and self-regulated learning.

In parallel, Guilford's (1967) concept of divergent thinking underscores the importance of stimulating the ability to explore multiple and alternative solutions, an essential skill in navigating complex and dynamic learning environments.

Alongside these elements, research in multimedia learning shows that the coherent integration of text, image, and sound reduces cognitive load and enhances comprehension (Mayer, 2009). In the present case, the integrated use of a visual avatar and verbal responses helped diversify information channels, consistent with general principles of multimedia learning.

However, as Kress (2009) points out, multimodality goes beyond the mere technical integration of sensory channels: it requires attention to non-verbal and symbolic forms of communication that become central to meaning making in enriched digital educational environments, where text, image, and voice combine to build understanding.

From this perspective, although the chatbot was not developed using rigorous segmentation protocols or advanced audiovisual management, the use of multimodal narrative strategies proved to be an effective lever in accordance with the principles of Universal Design for Learning, offering differentiated pathways for knowledge access and construction.

While multimodal sensory integration enhances conceptual processing, it can be further strengthened by the perspective of distributed cognition, which sees knowledge and mental processes as extended across networks of events, technologies, and shared practices (Hutchins, 1995; Hollan, Hutchins, & Kirsh, 2000).

Within this theoretical framework, the narrative chatbot can be understood as a functional extension capable of amplifying the student's reasoning, memory, and reflection throughout the learning process.

Additionally, Siemens' (2005) theory of connectivism emphasizes that in the internet era, knowledge resides in the connections themselves: the ability to weave relationships between data, sources, and informational communities becomes a core competence. Vaughan, Cleveland-Innes, and Garrison (2013) extend this notion by highlighting the importance of personalized and self-organized learning environments in which the use of conversational agents serves as a key factor for student empowerment.

Beyond knowledge construction and management, this experience also highlighted a crucial dimension: the emergence of autonomous learning agency on the part of the student. In this context, agency refers to the student's ability to take an active,

intentional, and reflective role in her own learning process (Bandura, 2001). Through continuous interaction with the chatbot Veronica, the student not only formulated responses but actively redefined her cognitive goals, restructured conceptual connections, and negotiated meanings through dialogue.

This activation of higher-order cognitive processes aligns with the principles of cognitive apprenticeship (Collins et al., 1989), in which learning is guided by the progressive internalization of expert thinking strategies. Through ongoing interaction with the avatar Veronica, the student engaged in branched dialogic pathways and received simulated responses, enhancing emotional involvement and promoting deeper conceptual elaboration.

Another key outcome was the chatbot's ability to stimulate critical thinking skills, moving beyond mere content delivery. Through open-ended questions, reflective feedback, and narrative reconstructions, the chatbot continuously encouraged the student to question assumptions and formulate more articulated responses. In addition to supporting the recall and consolidation of knowledge, the interaction triggered critical reworking of content, fostering analytical thinking and independent evaluation.

Beyond knowledge processing, the interaction with Veronica also encouraged a dialogic, Socratic approach (Vlastos, 1991), which stimulated analytical reasoning and autonomous evaluation, consistent with critical thinking scaffolding practices described by Halpern (2014). These emphasize the role of dialogue in building higher-order cognitive skills, where the objective is to facilitate the development of analytical, inferential, and evaluative competencies.

2. Methodology: Designing a formative interaction through narrative AI

This project is situated within the framework of ongoing research activities conducted at the University of Cassino and Southern Lazio and culminated in the successful defence of a master's thesis in Pedagogical Sciences on April 14, 2025. The defence was carried out collaboratively by the student and the avatar-based chatbot Veronica.

The primary objective was to develop a narrative chatbot, represented by an avatar modelled after the student, named Veronica in her honour, designed to support the preparation and defence of the master's thesis through an immersive and personalized interaction. The intent was to experiment with a dialogic learning model in which the student could act as a co-designer of an educational ecosystem

aimed at fostering knowledge acquisition and consolidation, critical reflection, metacognitive awareness, and independent thinking.

The development of the chatbot followed a multi-phase process. Initially, all materials produced during the thesis preparation were collected and organized, including the full thesis text, bibliographic references, and supplementary notes. This corpus was digitized, where necessary, using OCR technologies and subsequently structured into a thematically organized Knowledge Bank, comprising key conceptual areas: Artificial Intelligence (definitions, history, and applications); AI and bias; explainability; AI and inclusion; educating about AI; AI applications in education; and avatars in educational contexts.

The next step involved adapting this content into text formats compatible with the selected platform. Particular attention was paid to ensuring semantic coherence, terminological clarity, and functional conceptual categorization for effective conversational use. In doing so, the Knowledge Bank was developed as a semantic archive structured by key themes, with each document enriched with metadata to facilitate contextual retrieval.

To build the personalized chatbot/avatar, an integrated solution based on two complementary environments was employed:

- Convai, used to design the chatbot's narrative mind and conversational logic;
- Unity, employed for the 3D modelling of the avatar and the proxemic (spatial and gestural) elements of the interaction.

In Convai, the chatbot's narrative mind was structured through the definition of semantic triggers and branched conversational nodes. Content from the Knowledge Bank was mapped onto key points of the dialogic structure, enabling adaptive responses based on user input, resulting in coherent and thematically organized interactions.

Simultaneously, in Unity, the avatar was modelled in 3D using facial scans of the student. Facial expressions, lip-syncing, gestures, and proxemic elements were implemented to enhance relational dynamics and foster a sense of presence in the artificial agent.

The resulting interface is intuitive and accessible, with narrative and visual elements designed to facilitate user engagement and navigation.

At the core of this system lies the construction of the character's cognitive framework, a well-defined "mind" aligned with the student's profile. The goal was to develop a character with a personal backstory and a clear mission: to defend a

thesis in Media Education as part of the master's program in Pedagogical Sciences. The backstory serves to add depth, coherence, and realism to the character and reflects personal experiences, such as cultural background, education, and life circumstances, that contribute to shaping identity.

A suitable synthetic voice and interaction language were selected, along with facial and bodily movements to enhance the visual realism of the interaction. A set of balanced and reassuring traits was chosen to reflect the student's personality.

Narrative design was a methodological cornerstone of the project, integrating artificial intelligence with a dynamic narrative structure, allowing the chatbot to adapt fluidly to users' needs and preferences. The flow of interactions was based on a branched narrative framework, divided into macro-themes and micro-conversations. Each conversational node was activated by semantic triggers, key words or phrases in simulated questions, capable of prompting relevant and coherent response modules.

Starting from a reconstruction of potential questions from the thesis committee, the work led to the creation of interlinked thematic clusters and adaptive conversational modules. These were designed to simulate a realistic dialogic environment and encourage a metacognitive approach to thesis preparation.

By structuring the conversation flow in a clear and engaging way, the narrative, as emphasized by Bruner (1991), played a central role in supporting comprehension and meaning-making, allowing students to interpret events and experiences effectively.

Following the definition of the macrostructure and narrative creation, the system underwent an extensive testing and calibration phase, including simulations with different interlocutors. The objective was to test the semantic recognition of questions, response coherence, and content accuracy.

Special attention was dedicated to the prevention of semantic hallucinations by conducting controlled iterations for each conversational node, verifying relevance against the Knowledge Bank, and revising ambiguous or decontextualized content. At the same time, the chatbot's language was harmonized with the discursive style appropriate to the academic context, calibrating register, tone, and terminology.

The integration of the avatar's physical and vocal presence with textual dialogue enabled information delivery across multiple channels, enhancing comprehension and sustaining emotional engagement. This methodological choice aligns with the principles of multimodal learning (Mayer & Moreno, 2003), which assert that

combining visual, auditory, and interactive inputs optimizes conceptual processing and cognitive load management.

3. Analysis and Discussion: Narrative AI as a formative agent in the thesis process

The experience conducted with the narrative chatbot Veronica has highlighted the potential of an artificial agent, designed on solid narrative and pedagogical foundations, to act as a facilitator of reflective learning throughout the thesis preparation process.

Through continuous dialogue between the student and the chatbot Veronica, a dialogic learning space was established in which the boundaries between teacher and learner gradually dissolved, fostering a cooperative and peer-like interaction.

The observations collected validate and concretely articulate previously outlined theoretical models, particularly those concerning the dialogic construction of knowledge (Vygotsky, 1978; Papert, 1980), the educational value of narrative (Bruner, 1991), metacognitive support and critical thinking (Collins et al., 1989; Halpern, 2014), and the principles of accessibility and multimodality inherent in Universal Design for Learning (CAST, 2018).

From the earliest sessions, Veronica modulated her responses based on semantic triggers, rendering complex content, such as algorithmic bias mitigation, more accessible through the fluid integration of narrative examples, contextual analogies, and concrete references.

This interaction served as a stimulus for deeper inquiry and critical reflection, aligning with the principles of cognitive apprenticeship (Collins, Brown & Newman, 2018) and supporting a multimodal, layered engagement with knowledge, understood as the integration of diverse narrative registers (Mayer, 2009; Kress, 2009), consistent with Universal Design for Learning.

The chatbot also functioned as a metacognitive scaffold by employing expanded paraphrasing and references to academic sources, encouraging interdisciplinary transfer between pedagogy, ethics, and artificial intelligence, in line with the distributed cognition paradigm (Hutchins, 1995).

In several sessions, Veronica activated response modules that stimulated strategic planning and conscious self-assessment, thereby promoting higher-order executive functions through metacognitive prompting, as reflected in the practices described by Flavell (2024) and Brown (1975).

Given the student's direct involvement in designing the conversational agent, the interaction constituted a deliberate exercise in self-assessment, in which Veronica's narrative responses were leveraged to refine critical reflection and content planning.

This guided dialogue catalysed a notable transformation: the student moved from an initially receptive stance to a proactive posture, beginning to autonomously explore her own zones of uncertainty. This evolution is in alignment with self-regulated learning models proposed by Zimmerman (2002) and Chi et al. (1994).

The affective dimension also emerged as a key value. Through empathic language strategies, Veronica fostered a climate of trust, reducing performance anxiety and enhancing intrinsic motivation, as emphasized by Fredrickson (2001) in her studies on affectivity and self-regulated learning. In an interview with La Repubblica, the student stated: "Her calm reassured me."

Veronica acted as a facilitator in developing metacognitive strategies such as planning, monitoring, and evaluation. Through ongoing interaction, the student honed her capacity to reflect on and strategically modify her cognitive processes. Moreover, the chatbot's branching narrative structure encouraged divergent thinking, prompting the elaboration of multiple solutions to a single problem (Guilford, 1967).

Dynamic personalization of feedback contributed to enhancing perceived self-efficacy, thereby improving motivation and supporting more stable self-regulated learning. This approach mirrors the Adaptive Expertise model (Hatano & Inagaki, 1986), where cognitive flexibility is gradually cultivated through challenging yet accessible experiences.

Simulating the role of a "virtual teacher" supported the student's consolidation of knowledge through a learning-by-teaching approach (Fiorella & Mayer, 2013).

Though artificial, the chatbot Veronica became embedded in a broader educational ecosystem involving the supervisor, thesis committee, and peers, positioning itself as a central node in an idea exchange network. This configuration aligns with the principles of distributed mentoring (Campbell et al., 2016), where digital learning environments extend formative support well beyond the traditional one-to-one relationship.

From an epistemological standpoint, the experiment confirmed the importance of building ethically responsible educational chatbots. Veronica was designed according to the principles of information ethics (Floridi, 2014), promoting critical

exploration, tolerance for uncertainty, and independent source evaluation, consistent with AI ethics frameworks outlined by UNESCO (2021).

A final noteworthy element is the chatbot's capacity to foster inclusive education. Through multimodal adaptation and diversified communication channels, Veronica enabled the student to explore learning pathways tailored to her cognitive preferences.

According to Meyer, Rose, and Gordon (2014), Universal Design for Learning promotes the creation of educational environments that proactively accommodate student variability. The use of a narrative AI designed in accordance with these principles has proven to be a powerful tool for ensuring accessibility, personalization, and active participation.

In conclusion, the analysis of this experience confirms that a narrative chatbot, when thoughtfully designed with pedagogical intent and enriched by metacognitive and narrative practices, can serve as a multifaceted formative agent, capable of stimulating critical reflection, supporting self-regulation, and fostering deep and transferable learning.

Conclusions

The conducted experiment demonstrated that a narrative chatbot, when designed in line with robust pedagogical principles and grounded in rigorous epistemological foundations, can become far more than a mere support tool, it can serve as a genuine co-agent in the learning process.

Throughout the interactions, the student was not a passive recipient of information but an active co-constructor of meaning, exploring interdisciplinary connections and developing advanced metacognitive competencies.

In this way, the chatbot emerged as a catalyst for critical reflection, strengthening self-regulated learning and supporting the development of knowledge that is both personal and transferable.

The findings confirm the value of approaches rooted in distributed cognition, narrative pedagogy, and Universal Design for Learning, laying the groundwork for innovative educational models that integrate advanced technologies without sacrificing humanistic values.

This is not about replacing teachers or human interaction but about expanding formative potential through artificial intelligences capable of acting as epistemic, empathetic, and inclusive interlocutors.

Nonetheless, the experience also underscores the imperative of rigorous ethical design: educational AI must be transparent, controllable, non-manipulative, and oriented toward promoting critical autonomy.
In this regard, Floridi's (2014) philosophy of information provides a vital compass: to consciously inhabit the infosphere is to construct information environments that respect individuals' cognitive dignity and foster their holistic development.
The future implications of this experimentation open exciting possibilities: adaptive learning environments based on narrative chatbots, empathetic agents that support lifelong learning, and ethical simulators for critical AI literacy training.
The dialogue between education, technology, and philosophy must continue, guided by the awareness that learning today is not only about what we know, but also how and why we construct knowledge together, as humans and machines.
This approach paves the way for new opportunities in the educational landscape, potentially offering innovative tools to support and enhance learning processes in holistic and inclusive ways

Author contributions

The article is the result of the joint work of the authors, who together planned and created the structure and contents. Given the above, A. Sozio wrote the introduction, P.A. Di Tore the conclusions, M. Di Domenico the paragraphs 1, Theoretical framework: Cognitive technologies and learning agency and 3, Analysis and Discussion: Narrative AI as a formative agent in the thesis process and G. Amendola the paragraph 2 Methodology: Designing a formative interaction through narrative AI.

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