When a Reading Club Meets a Robotic Don Quixote: Embodied GenAI for Literary Dialogue*

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Abstract

This paper presents the design and development of *RoBook*, a social robot–led book club centred on *Miguel de Cervantes' Don Quixote*. As part of this book club, we introduced an activity in which NAO, a social robot, invited participants to interact with the novel's protagonist through dialogue, gesture, and shared interpretation. The activity follows a multiphase design aligned with the Educational Robotics Applications (ERA) framework, which provides design principles for developing and analyzing educational robotics activities. The ERA framework is structured around the following dimensions: context, a literature-based learning environment integrating technology-mediated social interaction; objectives, to promote literary interpretation, collaboration, and critical reflection on classical and contemporary themes; technology, the NAO social robot integrated with generative AI; roles, NAO embodying *Don Quixote* as facilitator and participants adopting story characters; and learning outcomes, meaningful engagement, motivation, and interpretive depth through embodied and dialogic interaction. The activity unfolds across four phases: (1) introduction and role assignment; (2) interactive engagement with NAO to identify items and themes contextualized to the book; (3) group collaboration focused on interpretation and discussion; and (4) a collective interaction in which participants experience *Don Quixote* reflecting on global warming, serving as a contemporary challenge that extends beyond the boundaries of the book's narrative. A preliminary evaluation with 24 higher education students indicated that the activity was educationally enriching, engaging, and appealing, fostering a perceived deeper literary understanding and satisfaction. *RoBook* extends the ERA framework by introducing new dimensions of Narrative Embodiment and Cultural Mediation, demonstrating how generative AI can enhance educational robotics to support immersive, literature-based learning experiences.

Keywords

Social Robotics, Generative Artificial Intelligence (GenAI), Educational Robotics Application (ERA)

1. Introduction

The rapid advancement of Social Robotics (SR) and Generative Artificial Intelligence (GenAI) is opening new opportunities for education across diverse disciplines [1–3]. While SR and GenAI hold significant promise for educational innovation, their integration into humanities education remains at an early stage [4]. This integration demonstrates the innovative nature of interdisciplinary convergence and highlights the opportunities and persistent challenges of implementing GenAI within human–robot interaction frameworks. The combination of embodied robots with GenAI allows learners to interact with cultural stories, literary figures, and philosophical concepts in engaging, interactive, and immersive ways [1, 4, 5]. Hence, interactions in manners are often addressed in book clubs, which consist of gatherings in which participants discuss their thoughts on a common literary work. Book club interactions are credited with educational advantages because members have the chance to collaborate, discuss, and learn together about social and cultural topics connected to the books they read [6]. This paper describes the design and development of *RoBook*, a

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Social Robot (SR)-led reading club focused on the novel *Don Quixote* by *Miguel de Cervantes*. *RoBook* integrates Generative AI (GenAI) capabilities into the robot's operation, enabling adaptive dialogue and dynamic interaction with participants. This enables participants to engage with an SR serving as an embodied agent capable of generating adaptive and emotionally attuned responses. The innovative entablements introduce a new dimension of reciprocity and agency, transforming traditional book clubs' activities into ones incorporating a hybrid form of human–AI collaboration combining SR and GenAI. *Robook* involves NAO, a robot embodying *Don Quixote.* These participants were invited to interact with the robot playing the role of the book's protagonist through dialogue, gestures, and shared interpretation. In this activity, participants engage in role-play, interactive tasks, and reflective discussions with NAO, which embodies the persona of the book's protagonist through expressive gestures, synthesized voice, and narrative style. *RoBook* is structured as an educational activity designed to deepen participants' understanding of the novel and its characters and foster collaborative, participatory, and emotionally engaging learning experiences. This aligns with recent work emphasizing collaborative learning as a form of constructivist practice, where group work serves as a space for shared meaning making and reflective engagement [7]. The design and development of this activity build on prior research demonstrating how SRs can effectively serve as educational facilitators and motivators capable of supporting collaborative and interactive learning across various educational contexts and settings [2, 8]. The present work extends this trajectory through the lens of the Educational Robotics Application (ERA) framework, which structures the design of robotics-based learning experiences across defined dimensions [9]. In this respect, we aspire to demonstrate how SR, empowered by GenAI, can act as a cultural mediator in the humanities, bridging classical literature with contemporary moral and social challenges. In this context, the NAO functions as a cultural mediator, understood as an embodied agent that bridges literary narratives and contemporary social issues by facilitating dialogue, interpretation, and shared meaning-making among participants [10, 11]. Through the design, implementation, and preliminary evaluation of *RoBook*, this study provides a concrete example of an SR embodied with personality and supported by GenAI capabilities. Furthermore, it presents an implementation that offers an opportunity to evolve the ERA framework in the era of Generative AI. Accordingly, this study is guided by the following research questions:

RQ1: How can a social robot enhanced with generative AI be designed to support a literature-based reading club activity aligned with the Educational Robotics Application (ERA) framework?

RQ2: How do participants perceive engagement, embodiment, and educational value in a social robot–led GenAI-supported reading club activity?

RQ3: How does positioning a social robot as an embodied literary persona and cultural mediator support collaborative interpretation and reflective engagement with classical literary works?

2. Related work

The field of educational robotics has been widely explored as a means of enhancing motivation, engagement, and collaborative learning [2, 12–15, 10]. The ERA framework proposes five guiding principles–Intelligence, Interaction, Engagement, Equity, and Practicality–for designing and evaluating educational robotics activities [9]. This framework has been employed to structure learning scenarios in which robots act as tutors, peers, or facilitators, emphasizing the importance of embodiment and interaction in the educational process. Building on the principles of the ERA framework, this approach aligns with recent evidence showing that educational robots have been employed as tutors, peers, and facilitators in learning scenarios, where embodiment and interaction play critical roles in shaping learner engagement and outcomes [12]. The NAO SR has been extensively studied as a mediator of learning activities [5, 13, 14]. Prior research has demonstrated the effectiveness of the NAO robot in team-based training environments, where it served as a tutor guiding group problem-solving [2, 11]. This resonates with broader educational findings regarding the effectiveness of group learning

environments. When intentionally structured, they promote deep learning by encouraging dialogue, negotiation, and shared reflection [7]. Studies have suggested that NAO can act as a motivational catalyst offering humanlike interaction, multimodal feedback, and adaptive responses, contributing to increased learner engagement and persistence in diverse educational settings, including those exercised collaboratively [12]. The rise of GenAI introduces new possibilities for SR interactions. Recent literature emphasizes its transformative potential in higher education along with its broader implications for human–robot collaboration and ethics [3, 4, 2, 16]. Integrating Generative AI into social robots, such as NAO, enables them to move beyond scripted interactions, producing adaptive and contextually rich dialogues that can incorporate cultural, ethical, and philosophical dimensions. This synergy broadens the educational potential of educational robotics, extending its reach into domains such as language learning, cultural dialogue, and moral reflection [5, 10, 2]. A previous study has demonstrated the roles of SR as a tutor, motivator, and facilitator, and while GenAI has been examined for its potential in broader educational settings, there remains a limited body of work [15]. We aim to address this limited body of work by combining SR and GenAI for humanities-focused learning experiences. In this respect, we present our efforts to design, develop, and implement *RoBook* to address this gap. We positioned NAO as an embodied literary persona, engaging participants in collaborative, reflective, and culturally grounded dialogue.

Recent studies have begun to explore the integration of generative AI and large language models into social robots, including NAO, enabling more adaptive and context-aware dialogues in educational settings. Studies have demonstrated the potential of GenAI-enhanced robots to support language learning, tutoring, and interactive task guidance by moving beyond scripted interactions toward dynamically generated responses [5, 17]. While these efforts highlight important advances in human–robot interaction and AI-supported learning, they largely focus on skill acquisition, task performance and domain-specific tutoring scenarios.

However, the potential of combining NAO and generative AI to support humanities-oriented learning experiences that rely on narrative engagement, role-play, and cultural mediation remains underexplored. Existing studies rarely address the use of embodied robots as literary or cultural personas that mediate interpretation, ethical reflection, and collaborative meaning-making over extended, multi-phase activities. This study addresses this gap by positioning the NAO robot, enhanced with generative AI, as an embodied narrative agent facilitating a literature-based reading club. Through role adoption, dialogic interaction, and contemporary moral reflection, RoBook extends prior research by demonstrating how GenAI-powered social robots can support immersive, culturally grounded, and interpretive learning experiences in the humanities.

3. From Learning Objectives to Activity Design

Building on the Educational Robotics Applications (ERA) principles introduced in Section 2, the design of RoBook focuses on the operationalization of these principles through intertwined learning objectives that align with educational goals, learner engagement, and technological affordances [9, 18, 19]. The design of *RoBook* was guided by intertwined learning objectives aligned with Educational These principles, providing a framework for ensuring coherence between educational goals, learner engagement, and technological affordances. The activity focused on enhancing literary comprehension by placing NAO, as SR embodied in *Don Quixote*, within its historical and philosophical contexts, emphasizing lasting moral questions and their relevance today. Moreover, Participants reflected on the parallels between the novel's episodes and present-day dilemmas, fostering transferable and interdisciplinary insights consistent with Sustainable Learning and Curriculum and Assessment principles. On the process level, *RoBook* embodied the Interaction, Engagement, and Embodiment principles through dialogue, role-play,

and reflection, structured across four phases that activated the cognitive, emotional, and social dimensions of learning. Our activity is organized into four sequential phases, beginning with participants being (1) introduced to the context of the story and assigned roles that represent characters from the book, who interact with *Don Quixote* as portrayed by the NAO the Robot. Subsequently, participants engage in (2) an interactive exploration phase, which involves group consultation to identify objects, locations, and themes derived from the novel's universe. Next, they engage in (3) collaborative interpretation involving group discussions on the moral, social, and emotional aspects of the story through natural language dialogue with the robot. Finally, participants engage in (4) contemporary reflection through group discussions focused on current issues related to global warming. There, the NAO formulates and tells a story consisting of different views on the topic while reflecting the personality of the book's protagonist. NAO's personification as the book's protagonist, enhanced by generative AI and an external text-to-speech API, produced a credible portrayal of the robot consistent with its familiar appearance and pathos, as recognised by movie audiences and readers of the novel [20]. Within the ERA framework, we addressed its principle by powering the NAO dialogue system with generative AI to enable context-aware and meaningful interactions (see Figure 1). In this context, the educational grounding of the ERA framework draws on constructivist and sociocultural learning theories, which emphasize learning as an active, socially mediated process of meaning-making rather than the passive acquisition of knowledge. From a constructivist perspective, learners build understanding through interaction, reflection, and engagement with authentic tasks [7]. Socio-cultural theory further highlights the role of mediation, dialogue, and cultural tools in shaping learning and positioning interaction. Here, we consider an embodied robotic agent, which is central to cognitive and interpretive development [10]. Within RoBook, the robot functions as a mediating artefact that scaffolds dialogic learning and shared interpretation, aligning with views of learning as socially situated and culturally grounded, and with recent work on collaborative learning supported by generative AI [10, 11].

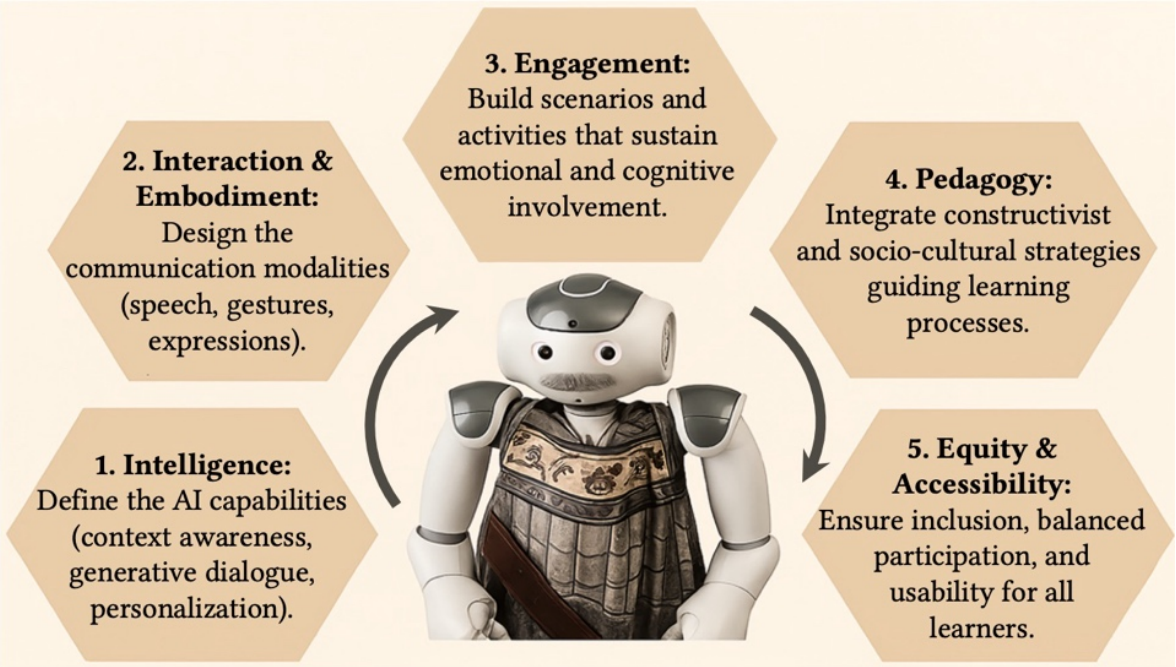

Figure 1: Operationalization of the ERA Framework in the *RoBook* Activity

The figure depicts the ERA principles as a conceptually ordered design process that guides the development of RoBook. As illustrated, the process begins with intelligence, establishing

generative and context-aware dialogue capabilities; progresses through Interaction & Embodiment, defining multimodal communication; and continues with engagement, designing emotionally and cognitively immersive learning scenarios. Pedagogy anchors these components in constructivist and sociocultural theory, while Equity & Accessibility ensure inclusivity and balanced participation. Together, these principles structured the systematic integration of Generative AI and Social Robotics, transformed into educational concept aspiring to provide a learning experience that is effective, adaptive and inclusive.

4. Activity Evaluation in the Light of ERA Framework

The evaluation of *RoBook* was conducted with higher-education students who participated in a *Don Quixote*–based reading club activity Guided by the ERA framework for its design[9, 18]. The reading club was organized as a voluntary, extracurricular educational activity associated with a higher-education program, designed to promote collaborative literary discussion and reflective engagement with classical texts. Participants were recruited from across the institution and joined the activity as part of an enrichment initiative rather than as a graded course requirement. The NAO robot was intentionally introduced into this context to explore how an embodied social robot, enhanced with generative AI, could extend traditional reading club practices by assuming the role of a literary persona and facilitating dialogic, participatory interaction. This setting provided an authentic yet flexible educational environment for examining the participants' experiences with robot-mediated literary dialogue. We examined participants' experiences across technological, educational, and affective dimensions. Data were collected through post-activity anonymous questionnaires and qualitative reflections gathered after six sessions, with a total of twenty-four participants (*71% female, aged 22–61, M = 28, SD=9.78*). These data were intended to provide a formative and exploratory assessment of participants' perceived engagement, satisfaction, and educational value of the activity, rather than to measure objective learning outcomes. The questionnaire included ten Likert-scale items (1 = strongly disagree, 5 = strongly agree) and open-ended questions designed to capture participants' perceptions, satisfaction, and learning outcomes in alignment with the ERA principles: Intelligence, Interaction, Embodiment, Engagement, Personalisation, Pedagogy, Equity, and Practicality. The quantitative findings revealed high levels of engagement, originality, and satisfaction, along with moderate technological stability. Participants rated the activity as highly innovative (*M = 4.83, SD = 0.38*) and original (*M = 4.88, SD = 0.34*), while satisfaction with the activity reached (M = 4.50, *SD = 0.7*). The clarity of the instructions was also rated highly (*M = 4.54, SD = 0.5*), and communication with NAO received a positive mean score (*M = 4.33, SD = 0.87*), reflecting the strength of the Interaction and Embodiment dimensions. However, continuity of operation obtained a lower score (*M = 3.92, SD = 1.2*), suggesting that occasional technical interruptions impacted flow and highlighted the practicality dimension as a challenge. Participants reported that the role-playing activity enhanced their experience (*M = 4.21, SD = 0.98*) and improved their understanding of the novel (*M = 4.08, SD = 1*). They also indicated that they learned new things (*M = 3.83, SD = 0.9*) and expressed a strong interest in participating in similar activities in the future (*M = 4.21, SD = 0.83*). Collectively, these results demonstrate a strong realization of the Engagement, Embodiment, and Pedagogy principles, with partial fulfilment of Practicality due to technical limitations. This interpretation is supported by both quantitative and qualitative evidence. The strong realization of the Engagement principle is reflected in high mean scores for items related to interest, originality, and willingness to participate in similar activities in the future, as well as qualitative themes describing the experience as "immersive," "fun," and "unique." The Embodiment principle is evidenced by participants' positive ratings of communication with NAO and the role-playing activity, alongside qualitative comments emphasizing the robot's gestures, tone, and perceived presence as central

to the experience. Finally, the Pedagogy principle is supported by participants' reported gains in understanding the novel, opportunities for collaborative interpretation, and reflections highlighting active learning, discussion, and meaning-making facilitated by robot-led interactions. Taken together, the convergence of self-reported perceptions and recurring qualitative themes provides a coherent basis for characterizing the realization of these ERA principles as prominent. Qualitative analysis supported these quantitative patterns and revealed four recurring themes aligned with the ERA criteria. First, participants emphasized the importance of interaction and embodiment, describing the robot's communication as "fun," "immersive," and "different from any class before." Many highlighted the narrative dialogue and storytelling phase as the most engaging aspects, noting that NAO's tone, gestures, and personality contributed to the sense of realism and presence. Second, the theme of engagement and emotional resonance emerged strongly: participants referred to the experience as "unique," "like being in a 3D movie," and "surprisingly human." Third, participants described the activity as educationally enriching, appreciating the opportunities for active learning through question-asking, collaborative interpretation, and decision-making. These aspects contributed to a deeper understanding of the novel's themes and moral dimensions, confirming the constructivist orientation embedded in the ERA's Pedagogy and Sustainable Learning principles. Finally, practical and technical aspects emerged as limitations, with several participants noting slow or interrupted responses ("the robot should answer faster" or "reduce malfunctions"), underscoring the need for further refinement in system stability and orchestration.

Overall, the findings demonstrate that *RoBook* effectively operationalized the ERA framework within a humanities-based learning environment. The robot's integration of GenAI enhanced personalization and supported contextually meaningful dialogue, partially addressing the principles of intelligence and personalization. The immersive role-play, dialogic structure, and embodied interaction were viewed by the participants as fostering engagement, enjoyment, and interpretive depth, translating the Embodiment, Interaction, and Engagement principles into a lived learning experience. Simultaneously, occasional latency and overheating affected performance, underscoring the practicality challenges inherent in deploying real-time GenAI within embodied systems. Although the participant group spanned a relatively wide age range and exhibited a gender imbalance, the evaluation was not designed or powered to support robust subgroup analyses. Exploratory inspection of the questionnaire responses did not reveal systematic differences in engagement, satisfaction, or perceived learning value across age groups or genders. Accordingly, no inferential subgroup analyses were conducted. Future studies with larger and more balanced samples are required to examine the potential demographic effects more rigorously.

5. Discussion and conclusions

This study addressed three research questions concerning the design, experience, and educational role of a generative AI–enhanced social robot in a literature-based learning context. RQ1 focused on the design of RoBook and its alignment with the ERA framework, demonstrating how narrative embodiment and a multi-phase activity structure can operationalize ERA principles in humanistic education. RQ2 examined participants' perceptions of engagement, embodiment, and educational value, with the evaluation indicating high levels of perceived engagement, satisfaction and interpretive depth. RQ3 explored the role of the robot as an embodied literary persona, showing that this positioning supported collaborative interpretation, emotional engagement, and reflective dialogue around classical and contemporary themes.

The findings of this study demonstrate how *RoBook* integrates Generative Artificial Intelligence (GenAI) and Social Robotics (SR) within a socio-constructivist learning framework. In alignment with collaborative learning as a constructivist practice, the activity positions dialogue, reflection, and co-construction of meaning at the center of the learning process [10,

11]. Unlike traditional peer interactions, participants engaged with an embodied agent capable of generating adaptive and emotionally attuned responses, introducing a new dimension of reciprocity and agency that transformed the activity into a hybrid form of human–AI collaboration. From a socio-constructivist standpoint, GenAI acts as a cognitive and cultural mediator, enabling learners to externalize and refine their interpretations through continuous dialogue with NAO [10]. The robot's gestures, tone, and narrative coherence supported emotional resonance and sustained engagement, enhancing the affective foundations of reflective learning, an effect consistent with previous findings on flow and emotional tuning in human–robot interactions [2]. The literary narrative of *Don Quixote* became an interactive construct explored through generative dialogue, while educators assumed the role of orchestrators, balancing structured design with emergent interaction.

Importantly, the extension of the literary dialogue toward contemporary ethical and moral issues, such as global warming, was not intended as an external add-on to the activity but as a deliberate narrative transposition. Don Quixote's character, traditionally associated with idealism, moral conviction, and principled struggle against perceived injustice, provided a culturally grounded ethical lens through which participants could reflect on present-day dilemmas. By engaging with a modern global challenge through the voice and values of a classical literary protagonist, participants experienced a form of ethical distancing that supported reflective dialogue without the immediacy or polarization often associated with contemporary debates. In this sense, the embodied robot functioned not only as a narrative agent but also as a moral mediator, enabling participants to negotiate ethical meanings collaboratively within a socio-constructivist and culturally situated learning space. The technological domain requires new competencies in AI literacy and ethical awareness as educators and learners navigate the epistemic and affective implications of GenAI-driven collaboration. *RoBook* exemplifies how an embodied GenAI can mediate socio-constructivist learning by fostering engagement, empathy, and reflective depth. The Intelligence principle extends toward semantic and narrative co-construction, while Interaction, Embodiment, and Engagement acquire richer socio-emotional and reflective dimensions. Pedagogy and Personalization evolve toward adaptive orchestration responsive to learners' cognitive and emotional states, and practicality now integrates technical robustness with ethical alignment. From an instructional design perspective, the RoBook activity also aligns with several well-established learning models, including Merrill's First Principles of Instruction, experiential and problem-based learning, and reflective–recursive design approaches such as R2D2/R2DR [21–23]. The phased structure of the activity engages learners in problem-centred tasks, activates prior knowledge through role assignment, supports demonstration through embodied narrative interactions, enables application via collaborative interpretation, and encourages integration through collective reflection. In parallel, RoBook reflects the core principles of experiential and problem-based learning by situating learners in an authentic narrative context that promotes enquiry, dialogue, and shared meaning-making around complex moral and social issues. Simultaneously, the ERA-based design extends these established models by explicitly accounting for embodiment, human–robot interaction, and generative AI–driven dialogue as central educational resources. While traditional instructional design models typically assume human-led facilitation, the ERA provides a framework for conceptualizing how an embodied artificial agent can assume facilitative, narrative, and mediating roles within collaborative learning processes. In this sense, RoBook illustrates how the ERA complements and expands existing instructional design models by addressing dimensions such as embodied interaction, adaptive dialogue, and socio-emotional mediation, which are increasingly central in AI-enhanced learning environments. Collectively, these developments suggest the potential to extend the ERA framework beyond its original formulation, positioning it as a dynamic model capable of accommodating AI-mediated, adaptive, and ethically grounded learning environments in the future.

6. Future Efforts

An important direction for future development is the inclusion of joint design and co-creation processes between learners and robots. Building on its role as a learning companion, NAO could evolve from facilitating interpretation to actively supporting collaborative narrative construction, for example, by co-designing alternative story continuations, proposing narrative branches, or prompting learners to collectively "program" scenes through natural language interaction. In such scenarios, generative AI functions not only as a dialogic agent but also as a processing or programming agent, enabling learners to externalize ideas, test interpretations, and iteratively refine shared artefacts. Integrating joint design in this way has the potential to deepen learning, enhance collaborative problem-solving, and further leverage the strengths of social robots as partners in meaning-making, rather than as illustrators alone. Exploring these possibilities represents a promising extension of RoBook and aligns with the broader HRI perspectives on learning companions and co-creative human–AI systems.

7. Declaration on Generative AI

During the preparation of this work, the authors used Chat-GPT-4 and Grammarly in order to Grammar and spelling check. After using these tools/services, the authors reviewed and edited the content as needed and take(s) full responsibility for the publication's content.

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