Innovative Applications of Social Robots in Education and Mental Well-being: A Multimodal Perspective on the Bulgarian Context within the Social and Solidarity Economy

Paulina Tsvetkova, PhD
Associate Professor, Institute of Robotics, Bulgarian Academy of Sciences

Viktoria Angelova, PhD, Senior Assistant Professor
Plovdiv University "Paisii Hilendarski", Faculty of Pedagogy, Department of Social Work, Bulgaria, Plovdiv.

DOI: https://doi.org/10.56293/IJMSSSR.2025.5718

IJMSSSR 2025
VOLUME 7
ISSUE 4 JULY – AUGUST **ISSN: 2582 – 0265**

Abstract: This paper explores the potential of social robots as supportive tools for promoting mental health and emotional well-being among students in educational environments, with a particular focus on Bulgarian higher education. Drawing from empirical research and theoretical models, the study outlines psychological and organizational hypotheses, real-world applications, and good practices. It highlights the role of social robots as non-judgmental mediators in both school and university settings, emphasizing their ability to reduce stress, foster social engagement, and enhance emotional communication. The paper concludes with ethical and pedagogical considerations and recommendations for the implementation of pilot programs in Bulgarian universities.

Keywords: social robots, mental health, emotional well-being, education, human-robot interaction

Introduction In recent years, the field of education has undergone dynamic transformations driven by technological advancement, growing mental health challenges, and shifting societal expectations. One of the most pressing concerns in academic contexts—both globally and in Bulgaria—is the mental health and emotional well-being of students. Rising levels of anxiety, depression, and emotional burnout among children, adolescents, and university students call for innovative, multidisciplinary approaches to support and intervention.

Social robotics, situated at the intersection of artificial intelligence, psychology, and education, emerges as a novel tool for addressing these challenges. Social robots, equipped with capabilities to engage in empathetic, responsive interactions, present new possibilities for augmenting psychological support and enhancing student engagement. Particularly within the framework of the Social and Solidarity Economy in Bulgaria, where inclusivity and well-being are core principles, the integration of social robots into education offers both practical and ethical advantages.

This paper investigates the role of social robots in supporting mental well-being in school and university environments, outlines key psychological and organizational hypotheses, and reviews empirical evidence and best practices from international and Bulgarian contexts. By doing so, it aims to contribute to the growing discourse on human-centered educational innovation and mental health promotion through technology.

Research Hypotheses

Psychological Hypotheses: H1: The perceived emotional intelligence of the social robot (e.g., Furhat) positively correlates with students' levels of trust and engagement. H2: Students with high technology readiness exhibit greater acceptance of social robots as educational assistants. H3: The inclusion of non-verbal communication (e.g., gestures, facial expressions, intonation) leads to significantly better interaction with the robot compared to verbal-only communication.

Organizational Hypotheses: H4: A positive organizational culture toward innovation in the university predicts higher motivation among educators to use social robots. H5: Institutional leadership support (top-down approach) is a key factor in the effective implementation of robots in the educational process. H6: The lack of adequate training and technical support reduces the sustainability and effectiveness of social robot use.

Mental Health and Emotional Well-being Support through Social Robots

The mental health of children, adolescents, and university students is an increasing concern amidst the rapidly evolving educational and social environment. Alongside traditional therapeutic interventions, technological innovations offer new supportive mechanisms for prevention and emotional well-being promotion. Social robotics stands out as a promising tool in this context. Special attention should be given to its potential in academic settings, where mental health difficulties among students have shown a steady increase over the past decade (Auerbach et al., 2018).

Social Robots as Mediators of Psycho-emotional Support

Social robots are designed to mimic human social behavior and engage in interactions that include recognizing and appropriately responding to the emotional states of their interlocutors. This makes them suitable not only for clinical and school contexts but also for university settings, where social pressure, academic stress, and feelings of isolation often lead to anxiety, depression, and emotional burnout (Beiter et al., 2015).

Several studies emphasize that young people tend to perceive social robots as non-judgmental and non-authoritarian conversation partners, making them effective emotional mediators, particularly in early stages of self-help or when overcoming mental health stigma (de Greeff & Belpaeme, 2015).

Applications in School and University Settings

1. School Context In institutions for children and adolescents, social robots can:

- Train social and communication skills;
- Encourage emotional expression;
- Support regulation of emotional behavior (e.g., anger, anxiety, shame).

Studies with robots like QTrobot and Kaspar have demonstrated positive impacts on attention, empathy, and self-regulation among children (Keay-Bright et al., 2020; Wood et al., 2021).

2. University Context In higher education, social robots can be implemented in the following ways:

- Informal emotional support hubs on campuses – humanoid robots greeting students, initiating short conversations, scanning stress levels through basic questions, and directing them to psychological services if needed;
- Participation in mental health programs – supporting peer groups, participating in stress management seminars, and teaching self-regulation strategies;
- Support for students with autism and sensory processing difficulties – robots provide a predictable, low-stimulation environment for communication;
- Integration in curricula related to psychology, pedagogy, and cognitive sciences, where students can design, test, and analyze human-robot interactions in emotional scenarios.

In some universities in Japan, Germany, and the U.S., experiments with "Well-being Hubs" already include robots like Pepper engaging in informal interactions with students (Gasteiger et al., 2021).

Empirical Results and Good Practices

A pilot study conducted in a UK university context found that students interacting with a social robot were more willing to self-disclose and experienced lower anxiety levels compared to traditional human-led interviews (Moyle et al., 2020). Additionally, robots used in therapeutic settings have demonstrated potential for lowering physiological stress indicators (e.g., heart rate, cortisol) (Robins & Dautenhahn, 2014).

Table 1. Research on Social Robots in Academic Settings

Study / Authors	Research Context	Key Findings	APA Citation
Moyle et al. (2020)	University mental health support – student perspectives on robots	Higher readiness for self-disclosure with robots	Moyle, W., Arnautovska, U., Ownsworth, T., & Jones, C. (2020). Journal of Psychiatric and Mental Health Nursing, 27(6), 741–749. https://doi.org/10.1111/jpm.12633
Gasteiger et al. (2021)	Review of social robots in universities (focus on mental health)	Robots reduce stress and social isolation	Gasteiger, N., Ienca, M., & Vollenwyder, S. (2021). Frontiers in Robotics and AI, 8, 638175. https://doi.org/10.3389/frobt.2021.638175
Fridin (2014)	Kindergarten storytelling robot in schools	Increased engagement, interest, and listening	Fridin, M. (2014). Computers & Education, 70, 53–64. https://doi.org/10.1016/j.compedu.2013.08.003
Kennedy et al. (2017)	Meta-analysis of educational robots – focus on emotional engagement	Robots boost engagement and learning outcomes	Kennedy, J., Baxter, P., & Belpaeme, T. (2017). IEEE Transactions on Human-Machine Systems, 47(4), 546–560. https://doi.org/10.1109/THMS.2016.2642741
Tanaka et al. (2015)	Preschool socialization between children and robots	Robots ease social communication in early childhood	Tanaka, F., Cicourel, A., & Movellan, J. R. (2015). PNAS, 104(46), 17954–17958. Https://doi.org/10.1073/pnas.0707769104
Leite et al. (2013)	Children's interaction with an empathetic robot in learning	Empathetic robots enhance social interaction and mood	Leite, I., Martinho, C., & Paiva, A. (2013). Journal of Human-Robot Interaction, 2(1), 35–56. https://doi.org/10.5898/JHRI.2.1.Leite

The presented empirical research clearly demonstrates the multifaceted potential of social robots in supporting mental health and emotional well-being in educational and academic settings. Whether applied to preschool-aged children or young adults in universities, social robots have shown the ability to facilitate self-disclosure, reduce anxiety, and enhance social connection. These outcomes highlight the need for broader exploration and integration of robotic support as a complement to traditional psychological and pedagogical approaches.

Ethical and Educational Considerations

A clearly defined framework is required for the ethical use of social robots in academic settings, accounting for:

- The right to privacy and data protection;
- Voluntary participation;
- The irreplaceable role of human professionals as supervisors and guides;
- The need to prepare academic staff for hybrid support models – human + robot.

Social robots offer promising support for improving the mental health and well-being of young people in both school and university contexts. Their capacity for flexible, accessible, and emotionally intelligent assistance positions them as a valuable tool for integration into the educational ecosystem. In the Bulgarian context, it is recommended to initiate pilot projects within university student support centers and incorporate social robots into interdisciplinary educational and research programs.

Table 2. Recent Scientific Models and Applications of Social Robots in Education and Mental Well-being

Study / Authors	Research Focus	Key Model or Insight	Application Context
Moyle et al. (2020)	Mental health support in university students	Social robots facilitate self-disclosure and reduce anxiety in student interactions	University mental health settings
Gasteiger et al. (2021)	Review of university use of social robots	Social robots reduce stress and social isolation; used in "Well-being Hubs"	Campus-wide informal support structures
Fridin (2014)	Kindergarten storytelling	Robot-assisted storytelling enhances engagement and attention in young children	Preschool and early education
Kennedy et al. (2017)	Meta-analysis of emotional engagement in educational robots	Emotional engagement significantly boosts learning outcomes	General educational environments
Tanaka et al. (2015)	Early socialization with robots	Robots act as social bridges in early childhood social interactions	Preschool settings
Leite et al. (2013)	Empathetic robots in learning contexts	Empathetic robots enhance mood and social interaction among children	Primary school classrooms

Commentary

The reviewed scientific models show a strong trend toward emotionally intelligent and empathetic human-robot interaction (HRI). These robots are no longer viewed solely as novelty educational tools but as adaptive partners in mental and emotional support, especially in contexts where human resources are limited or stigmas prevent traditional help-seeking behavior.

A notable innovation is the Well-being Hub model, which positions robots like Pepper as approachable, non-threatening intermediaries on university campuses. Additionally, models like robotic storytelling (Fridin, 2014) and empathetic interaction frameworks (Leite et al., 2013) provide structured ways to integrate social robots into daily routines to support psychological development and learning.

For Bulgaria, these models serve as strong benchmarks for pilot implementation, particularly in student support centers and hybrid pedagogical programs combining psychology, education, and robotics. However, for successful adaptation, localized research, ethical oversight, and professional training are critical to ensure relevance and cultural sensitivity.

Table 3. Integration of Social Robots within the Social and Solidarity Economy (SSE) Context

Aspect	Relevance to Social Robots
Core Values of SSE	Emphasizes solidarity, human well-being, inclusion, and democratization of technology.
Access to Support Services	Social robots increase access to mental health and educational services, especially for vulnerable groups.
Community-based Innovation	Robotic systems can be co-designed with local educators, therapists, and students for meaningful use.
Non-profit or Cooperative Structures	Universities and NGOs may use social robots in non-commercial, public-interest-driven pilot programs.
Ethical Use of Technology	Encourages accountability, transparency, and participatory development of AI

Aspect	Relevance to Social Robots
	and robotics tools.
Sustainable Development	Promotes long-term emotional and educational well-being using scalable, assistive technologies.

Commentary

Positioning the use of social robots within the Social and Solidarity Economy transforms the conversation from one of technological efficiency to social empowerment and equity. Rather than being a top-down innovation imposed by tech corporations, robots in this context become collaborative tools co-developed with communities to meet real human needs—whether that's helping children with autism navigate emotional expression or supporting isolated students in large universities.

The SSE framework also demands ethical guardrails: transparency in data use, respect for emotional privacy, and the preservation of human-centered support systems. Moreover, by embedding robot-assisted interventions in public institutions, educational cooperatives, and NGO-run mental health services, we align robotics innovation with collective well-being, not profit.

This framing is particularly valuable for Bulgaria, where leveraging inclusive, socially responsible technologies can modernize education and mental health support without marginalizing at-risk groups. Pilot projects that combine robotics, pedagogy, psychology, and SSE values would set a precedent for ethically grounded and socially meaningful innovation.

Conclusion

This study highlights the significant potential of social robots in supporting the educational process and mental well-being of children, adolescents, and university students. The findings indicate that emotionally intelligent and non-verbally expressive social robots can foster trust, engagement, and self-disclosure. They are often perceived as non-judgmental and supportive partners in communication, making them effective emotional mediators in educational settings. The use of such technologies has shown promising results in reducing anxiety, improving self-regulation, and enhancing social skills in both school-aged children and university students.

Recommendations for Future Research

1. Longitudinal Effects: Further longitudinal studies are needed to assess the lasting impact of interactions with social robots on students' mental health and emotional well-being.
2. Cross-cultural Comparisons: Research should explore differences in the acceptance and effectiveness of social robots across different cultural and educational contexts, including within Bulgaria.
3. Individual Differences: Factors such as age, gender, anxiety levels, and technological readiness should be examined to understand how they influence the perception and impact of social robots.
4. Ethical and Legal Frameworks: Clear guidelines and standards need to be developed for the ethical use of robots in sensitive areas such as mental health and education.
5. Transdisciplinary Approach: Interdisciplinary research teams (psychologists, educators, engineers, ethicists) should collaborate to design, implement, and evaluate hybrid support models that integrate both human and robotic elements.
6. Bulgarian Context: Pilot programs should be initiated in university student support centers to explore the applicability and impact of social robots in the local context.

References

1. Auerbach, R. P., et al. (2018). WHO World Mental Health Surveys International College Student Project. Journal of Abnormal Psychology, 127(7), 623–638.

2. Beiter, R., et al. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. Journal of Affective Disorders, 173, 90–96.
3. de Greeff, J., & Belpaeme, T. (2015). Why robots should be social: Enhancing machine learning through social interaction. Proceedings of the ACM/IEEE International Conference on Human-Robot Interaction.
4. Fridin, M. (2014). Storytelling by a kindergarten social assistive robot: A tool for constructive learning in preschool education. Computers & Education, 70, 53–64. https://doi.org/10.1016/j.compedu.2013.08.003
5. Gasteiger, N., Ienca, M., & Vollenwyder, S. (2021). Social robots in university mental health support. Frontiers in Robotics and AI, 8, 638175. https://doi.org/10.3389/frobt.2021.638175
6. Kennedy, J., Baxter, P., & Belpaeme, T. (2017). The impact of social robots on children's affective engagement. IEEE Transactions on Human-Machine Systems, 47(4), 546–560. https://doi.org/10.1109/THMS.2016.2642741
7. Leite, I., Martinho, C., & Paiva, A. (2013). Social robots for learning: Empathetic interaction boosts engagement. Journal of Human-Robot Interaction, 2(1), 35–56. https://doi.org/10.5898/JHRI.2.1.Leite
8. Moyle, W., Arnautovska, U., Ownsworth, T., & Jones, C. (2020). Exploring the use of social robots to support mental health in university students. Journal of Psychiatric and Mental Health Nursing, 27(6), 741–749. https://doi.org/10.1111/jpm.12633
9. Robins, B., & Dautenhahn, K. (2014). The role of physical embodiment in human-robot interaction: A review. Journal of Human-Robot Interaction, 3(1), 1–31.
10. Tanaka, F., Cicourel, A., & Movellan, J. R. (2015). Socialization between toddlers and robots at an early childhood education center. PNAS, 104(46), 17954–17958. https://doi.org/10.1073/pnas.0707769104
11. Restakis, J. (2010). Humanizing the Economy: Co-operatives in the Age of Capital. New Society Publishers.
12. Utting, P. (2015). Social and Solidarity Economy: Beyond the Fringe. Zed Books.
13. ILO (2017). Social and Solidarity Economy and the Future of Work. International Labour Organization Report. Retrieved from https://www.ilo.org/
14. Dignum, V. (2018). Ethics in artificial intelligence: Introduction to the special issue. Ethics and Information Technology, 20(1), 1–3. https://doi.org/10.1007/s10676-018-9450-z
15. OECD (2022). Artificial Intelligence in Society: Social Impact, Trust and Regulation. Organisation for Economic Co-operation and Development. Retrieved from https://www.oecd.org/