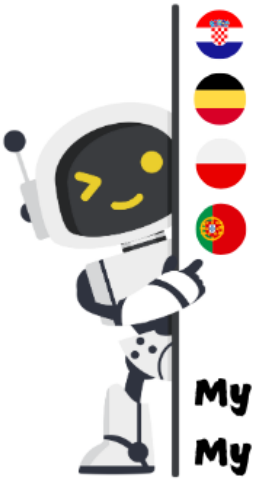

My Robot, My LearnMate

Analysis of the Current Landscape in Robotics, AI and Education for Sustainable Development

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Summary

This document aims to provide a thorough overview of the use of social robots in schools and to examine the current state of social robots and AI in education across partner countries.

We begin with an introduction to social robots as teaching assistants, highlighting key advantages and benefits of their integration into the educational process.

Following this, we present findings from an extensive literature review conducted to investigate research practices related to the use of social robots in schools. These findings provide insights into the types of robots used in educational settings, the duration of experiments, number of participants, education levels, and more. Additionally, we identify the main application areas for social robots and share teachers' valuable experiences with these technologies.

After the literature review, we focus on the current state of social robots and AI in education within partner countries. To achieve this, we developed an online survey distributed to schools in Germany, Poland, Portugal, and Croatia. Key findings highlight varying levels of integration and teacher readiness across the three countries. Croatia demonstrates the highest motivation among educators to adopt both robotics and AI, while Portugal excels in robotics training initiatives. Poland features a younger, more diverse teaching workforce, signaling potential for gradual adoption.

Challenges such as financial constraints, lack of training, and absence of national guidelines hinder broader adoption. Nonetheless, teachers and students show positive attitudes toward the use of these technologies, particularly for their motivational and practical benefits. The report emphasizes the need for improved policy frameworks, resource investment, and professional development to realize the potential of robotics and AI in creating inclusive and engaging educational environments.

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1. Social robots as teaching assistants

In recent years, education has undergone a transformative shift with the introduction of social robots into classrooms. These robots, whether humanoid or non-humanoid, are designed to engage with students in ways that go beyond traditional teaching methods, offering numerous benefits. As technology advances, educators and researchers are exploring new ways to use social robots to enrich the learning experience (Tolksdorf et al., 2021; Zhexenova et al., 2020). However, the adoption of these technologies varies significantly across schools and educational institutions. Factors such as budget limitations, infrastructure, and differing educational philosophies play a role in how widely social robots are integrated into educational practices.

Research on social robots in schools, while limited, has focused on several key areas:

Personalized Learning: One of the main advantages of social robots in education is their ability to facilitate personalized learning. These robots can adjust to individual students' learning styles, pacing, and preferences, offering tailored support and content. By addressing each student's unique needs, social robots help create a more inclusive and effective learning environment (Chen et al., 2020; Song et al., 2021; Yueh et al., 2020; Konijn & Hoorn, 2020; Peura et al., 2023).

Enhanced Engagement: Social robots create a dynamic and interactive classroom atmosphere. Through emotional expressions, eye contact, and non-verbal cues, they establish a connection with students that enhances engagement, especially for those who may struggle with traditional teaching methods or have special educational needs. They also help maintain a positive, supportive classroom environment (Chen et al., 2020; Sisman et al., 2018; Arar et al., 2021; Chalmers et al., 2022).

Language Development: For language learners, social robots serve as valuable tools for practicing communication skills. They provide pronunciation feedback, facilitate conversational practice, and engage students in language games, creating a safe and non-judgmental space to improve language proficiency. This is particularly beneficial in multicultural classrooms where students may come from diverse linguistic backgrounds (Sisman et al., 2018; Arar et al., 2021; Chen et al., 2020; Zhexenova et al., 2020).

Social and Emotional Learning (SEL): Social robots also contribute to the development of social and emotional skills. They guide students in building empathy, emotional regulation, and effective communication. Through role-play and interactive exercises, these robots support students' holistic development, preparing them for future social and academic challenges (Escobar-Planas et al., 2022; Ahumada-Newhart et al., 2023; Ali et al., 2021; Serholt, 2019).

Addressing Educational Gaps: Social robots hold potential in addressing educational disparities by offering additional support where resources are limited. In remote or underserved communities, these robots can supplement teachers by providing personalized

tutoring, homework help, and reinforcement of key concepts, thus helping to bridge gaps in educational access and quality.

Ethical Considerations: As social robots become more common in education, ethical issues such as privacy, data security, and their impact on human relationships must be carefully considered (Boch et al., 2020; Sibramanian, 2017; Newton & Newton, 2019; Wo et al., 2021). Clear guidelines and regulations are essential to ensure that social robots are used responsibly and ethically in educational settings.

In summary, social robots represent a promising innovation in the evolving landscape of teaching and learning. As technology progresses, it is crucial for educators, researchers, and policymakers to collaborate in harnessing the full potential of social robots while addressing ethical concerns to ensure they are used responsibly.

2. An overview of current experiments with social robots as teaching assistants in schools

The results presented in Table 1. show that NAO is one of the most popular social robots in education, used in as many as 9 out of 20 studies. The robot Pepper was used in two studies each, and the robots Jibo, SocibotMini, KaziEV5, Zenbo, Double2, VGo Robots Skusie, Haru, Emys, Julia, and Tega were used in one study each.

Table 1: Overview of analyzed papers

Author	Robot	Participants		Subject	Duration
		Number	Level		
Sisman et al. (2018)	NAO	232	secondary	language	4 months
Escobar-Planas et al. (2022)	Haru	84	primary	problem-solving	1 session
Arar et al. (2021)	Emys	54	primary	language	8 weeks
Yueh et al. (2020)	Julia	36	primary	literacy	1 session
Chen et al. (2020)	Tega	59	primary	language	48 sessions
Konijn & Hoorn (2020)	NAO	86	primary	mathematic	3 sessions
Kim et al. (2023)	Skusie	10	primary	friendship behaviours	2 sessions
Qu & Fok (2021)	KaziEV5	32	secondary	computational thinking	12 sessions
Chalmers et al. (2022)	NAO	96	primary and secondary	computational thinking, coding and language	3 years
Serholt (2019)	NAO	34	primary and secondary	-	3 months
LeTendre & Gray (2023)	Pepper	25	secondary	-	10 weeks

Peura et al. (2023)	NAO	50	primary and secondary	language	2 weeks
van Straten et al. (2023)	NAO	276	primary	science	1 session
Ali et al. (2021)	Jibo	172	primary	creativity	1 year
Song et al. (2021)	SocibotMini	31	secondary	music	1 session
Ahumada-Newhart et al. (2023)	Double2 i VGo Robots	53	primary and secondary	friendship behaviours	-
Zhexenova et al. (2020)	NAO	62	primary	language	1 session
Serholt et al. (2021)	Pepper	10	primary and secondary	mathematic	1 session
Osawa et al. (2022)	NAO	490	secondary	literacy	1 year
de Souza Jeronimo et al. (2022)	NAO, Zenbo	20	primary	music	-

The number of participants who actively participated in the research ranges from 10 to as many as 490. Studies are most often conducted among children of primary school age. Five studies were conducted among primary and secondary school age, five among secondary school age, and ten among primary school age.

The use of social robots is most common in teaching languages, as many as six studies have been conducted in this area. Two studies were conducted in the areas of literacy, mathematics, computational thinking, music, and friendship behaviors. One study per field was conducted in the areas of problem-solving, science, coding, and creativity. For two studies, the research area was not specified.

Considering the duration of teaching/learning and the use of social robots in the educational process, both short-term and long-term studies were carried out. Nine studies conducted educational activities for a period of two months to two years. Nine studies conducted educational activities as a one-time activity, while for two studies, the duration of the educational activity was not specified.

3. The main application domains of social robots in schools

In general, social robots were commonly used to assist in language learning, foreign language teaching, and other educational activities. They acted as assistants, peers, and reading companions, contributing to improved learning outcomes, engagement, and motivation among students. From the reviewed papers the following application domains could be recognized:

Language Learning	Robots are employed as language learning assistants, demonstrating success in teaching foreign languages to children and adults (Arar et al. (2021); Peura et al. (2022); Sisman et al. (2018); Chen, et al. (2020); Zhexenova et al. (2020); Chalmers et al. (2022))
Computational Thinking and Robotics Education	Robots are employed as language learning assistants, demonstrating success in teaching foreign languages to children and adults (Chalmers et al. (2019); LeTendre & Grey (2020); Qu & Fok (2021))
Children's Social and Emotional Development	Social robots play a role in motivating children to engage in various activities, fostering collaborative behaviors, and impacting children's perceptions of friendship and reliability (Konijn & Hoorn (2020); Serholt (2019); Ahumada-Newhart et al. (2023))
Creativity Support	Social robots are employed as creativity support tools for children, promoting high levels of creativity, exploration of unique themes, and generation of creative ideas (Ali et al. (2021))
Musical Instrument Practice	Robots are utilized in supporting roles during musical instrument practice, providing encouragement and feedback to children at different learning stages, influencing their motivation and persistence (Song et al. (2021); de Souza Jeronimo et al. (2022))
Library Activities	Social robots serve as reading companions in libraries, facilitating children's reading participation as alternatives to group storytelling activities (Osawa et al. (2022); Yueh et al. (2020))
Collaborative Friendship Development	Research explores the use of social robotic technology to assist young children with collaborative friendship development, showing positive behaviors in conversational robot mediation (Kim et al. (2023); Escobar-Planas et al. (2022); van den Berghe et al. (2021); van Straten et al. (2023))

Figure 1: Overview of main application domains of social robots in schools

3.1 Language Learning

Robots are employed as language learning assistants, demonstrating success in teaching foreign languages to children and adults. Demir-Lira et al. (2020) showed in their research that children successfully learnt a foreign language from a social robot as an assistant, as well as they learnt from a human teacher. Arar et al. (2021) researched the use of social robots in foreign language teaching and found that the use of social robots enhances the effectiveness

of the educational process and significantly improves learning outcomes. Furthermore, given the facilities offered by the social robot through its support for foreign language learning to children, the authors recommend the use of social robots for improving the quality of learning outcomes and comfort in the schooling conditions. Sisman et al. (2018) also confirmed positive experience with robots in language learning. They highlighted that a social robot can assume the role of an assistant and the role of a peer. This is in line with Chen, et al. (2020) who found that children who interact with the robot in the role of an assistant learnt more target vocabulary words than children who interact with the robot. Finally, an interesting experience is related to gamified robot-assisted language learning done by Peura et al. (2022). They investigated the impact of a social robot on the learning outcomes and how the robot motivates and enhances persistence in learning. The results showed that learners' knowledge improved during the experiment and that pupils' active participation became a natural part of the learning process. It was also shown that the robot is perceived as a motivating factor producing improved learning in pronunciation, even without the novelty effect of the robot.

3.2 Computational Thinking and Robotics Education

Robots are utilised in robotics education to cultivate students' computational thinking skills through interactions. Chalmers et al. (2019) delved into the effects of humanoid robots on the learning and engagement of students. Their findings underscore the positive influence of humanoid robotics technology on student engagement in the learning process. Through collaborative efforts, students not only honed their 21st-century skills—including creativity, critical thinking, communication, and collaboration—but also advanced their computational thinking and coding abilities. Notably, their curiosity reached new heights when tasked with the challenge of programming the robot to speak. Research on the effects on students and their conception of robots during long-term exposure to a robot in a project-based learning was investigated by LeTendre and Grey (2020). The research revealed both limitations and complexities in using social robots as interactive educational technology for young adolescents. While current technology hinders widespread deployment in public-school classrooms, well-designed interventions with social robots have the potential to motivate and engage students. Qu and Fok (2021) conducted a study aimed at fostering students' computational thinking through interactive experiences with robots in the realm of robotics education. Conducted during a summer camp, the study found a significant improvement in students' computational thinking skills. The duration of social interactions with the robot showed a notable correlation with this positive change, indicating that integrating robots into educational settings can effectively enhance students' cognitive abilities.

3.3 Children's Social and Emotional Development

Social robots motivate children, encouraging engagement in activities, fostering collaboration, and influencing perceptions of friendship and reliability. In self-directed play, robots support

friendships, contribute to self-expression, and enhance identity development. Konijn & Hoorn (2020) investigated the impact of a social robot on the learning process and, more specifically, the role of the robot's social behaviour in contributing to this educational impact. Results showed that social robots positively affect learning outcomes. Interestingly, the study found that the robot's more social behavior did not enhance the learning experience. The researchers focused on testing whether amplifying social cues had a beneficial impact on memory retention, rather than delving into relationship intricacies.

Establishing how children use robots for self-directed play activities and investigating the perspective and meaning of salient experiences, identify social structures, and identify processes in order to understand the meaning behind participant behaviour is an area that was investigated by Ahumada-Newhart et al. (2023). Their discovery revealed that children who believe in their ability to operate robots in remote school settings, along with a fondness for self-directed play, can use their robotic companions to foster general friendships. These children actively engage in play activities that contribute to self-expression and play a role in shaping their identity. Serholt (2019) explored children's perceptions of the child–robot relationship in an educational setting. Study showed that students who had interacted with a robot became more critical than their peers. The possibility of developing empathic relationships between robots and children based on affective data gathered about individual children.

3.4 Creativity Support

Social robots are employed as creativity support tools for children, promoting high levels of creativity, exploration of unique themes, and generation of creative ideas. Game-based child-robot interactions are designed to afford creativity, demonstrating positive effects on children's verbal, figural, and constructional creativity tasks. Ali et al. (2021) conducted research in which social robots were presented as creativity support tools for children in collaborative interactions.Their observations showed that individuals engaging with the robot displayed heightened creativity, exploring unique themes and generating more creative ideas. The study demonstrated that the robot's creative display and its supportive structures positively impacted children's creativity in verbal, figural, and constructional tasks. This research contributes significantly to the development of game-based interactions between children and robots, emphasizing creativity facilitation. It also provides compelling evidence for the effectiveness of such interactions and offers valuable guidelines for designing social embodied agents to nurture creativity in young children.

3.5 Musical Instrument Practice

Robots are utilised in supporting roles during musical instrument practice, providing encouragement and feedback to children at different learning stages, influencing their motivation and persistence. Song et al. (2021) investigated the impact of robots in different

supporting roles (i.e., evaluative role versus non evaluative role) on children's motivation in different learning stages in musical instrument practice. The results confirmed that children in different learning stages are more motivated with robots with different roles during practising. Robot roles have an impact on children's persistence, the encouragement and feedback provided by the robot may reinforce the self concept of the advanced players, which further improved their motivation.

3.6 Library Activities

Social robots serve as reading companions in libraries, facilitating children's reading participation as alternatives to group storytelling activities. Children perceive robot companions as favourable and desirable reading partners, inducing social interaction during reading sessions. Study conducted by Osawa et al. (2022) was focused on the role of the social robot as a first-time learner in motivating children out of their social roles. Authors observed changes in children's behaviour, such as spontaneous advertising activities, guidance from upperclassmen to lowerclassmen, collaboration with multiple people, and increased interest in technology.

The social robot as a reading companion to facilitate children's reading participation, as alternatives to group storytelling activities in libraries, was investigated by Yueh et al. (2020). The outcomes of their study discovered that children held a more favourable and desirable view of reading with a robot companion compared to a human co-reader. The cognitive examination gave intriguing findings, highlighting that human and robot companions each played distinct roles in enhancing the children's language comprehension, with both types of companions yielding similar performance outcomes. Interestingly, on the emotional front, the robot co-reader stood out by eliciting more social interaction during the reading sessions, adding a unique affective dimension to the overall experience.

3.7 Collaborative Friendship Development

Research explores the use of social robotic technology to assist young children with collaborative friendship development, showing positive behaviours in conversational robot mediation. Kim et al. (2023) investigated if social robotic technology could assist young children with collaborative friendship development. The authors found out that children showed liking behaviours in the conversational robot mediation, showed togetherness behaviours and agreement behaviour in the conversational robot mediation. Social robots need to be designed in a way that they are child-centred and collaborative because robot behaviours and collaboration paradigms affect children's perception about the robot. Escobar-Planas et al. (2022) prove in their research that the cognitive reliability of the robot shapes the helping relationship between the children and the robot, while the robot's expressivity impacts the perception of the robot's support ability and friendship.

Although the majority of analysed papers fell into one of the categories above, it needs to be highlighted that two papers reported the research in which it was investigated how children perceive robots. van den Berghe et al. (2021) studied child-robot interaction and found that children generally anthropomorphised the robot and a weak but significant correlation was established between children's increased anthropomorphism and their word knowledge. van Straten et al. (2023) conducted research on how children perceive and relate to a social robot that acknowledges its lack of human psychological capacities and machine status. The results of their research show that exposure to this information decreased children's feelings of closeness towards and trust in the robot. Children's tendency to anthropomorphize the robot mediated the effects of transparency on closeness and trust, while their perception of the robot's similarity to themselves only mediated children's feelings of closeness.

4. Current state of social robots and AI application in partner countries

The survey, conducted among teachers in Portugal, Poland, Germany and Croatia, provides insights into the current state of social robots and AI integration in education within these partner countries. The sample was obtained using a convenience sampling method, where teachers participating in the project shared the questionnaire within their professional networks, and these colleagues further disseminated it across their schools. While this approach enabled a broad reach, it may have resulted in a sample that reflects educators with greater interest or engagement in innovative teaching practices, rather than a fully representative population of teachers.

4.1 Demographics

The demographic data reveals several interconnected trends across respondents from the four countries, emphasizing relationships between gender, generational representation, teaching levels, experience, and subjects taught.

The gender distribution (Figure 1) shows a significantly higher representation of female teachers in all countries except Germany, which is connected with the predominance of primary-level teaching in Croatia (222 respondents) and Portugal (185) as shown in Figure 4. This aligns with global trends where women are more likely to work in primary education (Psaki et al., 2018). In Poland, while the proportion of male teachers is slightly higher compared to the other countries, the representation of secondary-level educators is also relatively greater (130 respondents), which could suggest a link between gender and educational level focus. In Germany, however, the small sample reveals an inverse pattern, with male teachers (63%) outnumbering female teachers (37%). This deviation, combined with the overwhelmingly high proportion of secondary-level educators (85%), highlights Germany as an exception in terms of gender and teaching level trends compared to other partner countries. This can be explained by the specific network of teachers in STEM which was used to invite teachers in Germany to participate in the survey.

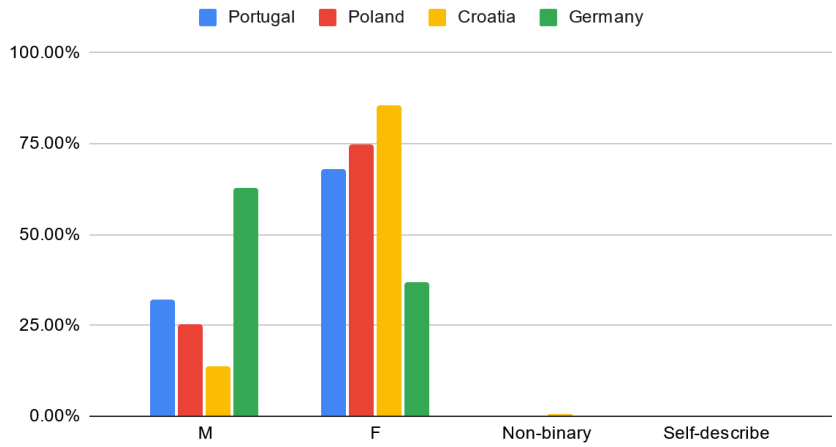

Figure 2: Gender distribution

A key pattern emerges when examining generational data (see Figure 2) in conjunction with teaching experience (see Figure 5). In Portugal, Generation X (238 respondents) dominates, and this group also represents the majority of experienced teachers with over 10 years of teaching, as shown in Figure 5 (309 respondents, see Figure 3). Similarly, in Croatia, the larger proportion of Generation X educators (143 respondents) corresponds with the 222 experienced teachers. Conversely, Poland shows a more diverse distribution of generational cohorts, including Millennials (42 respondents) and Generation Z (27), which corresponds with a slightly higher representation of teachers in the transitional phase (4–9 years of experience) out of 209 respondents. This indicates a gradual generational shift in the teaching workforce in Poland compared to Portugal and Croatia.

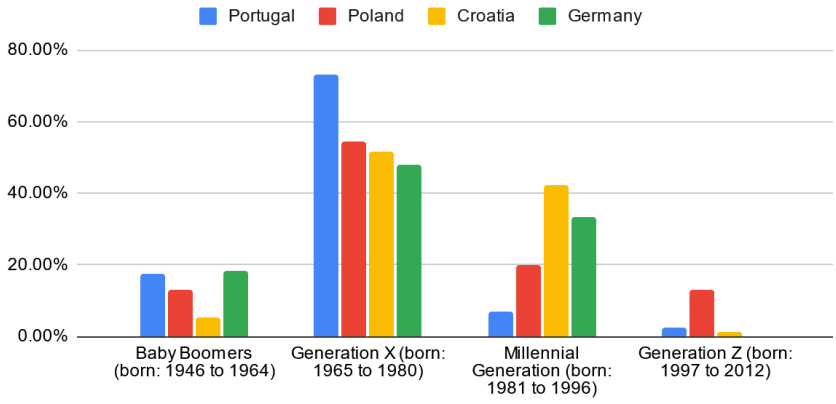

Figure 3: Generational distribution

Poland's unique demographic profile, based on the number of respondents (209) and a broader generational spread, highlights an ongoing shift toward younger educators. This is

further supported by the relatively higher percentage of beginning teachers (0–3 years of experience, 24 respondents) and Millennials (42 respondents) compared to Portugal and Croatia (see Figure 2). Meanwhile, the dominance of experienced teachers in Portugal and Croatia, paired with the prominence of Generation X, suggests a more stable, older teaching workforce. The data from Germany suggests a notable focus on seniority and stability within the teaching workforce, with 52% of respondents having over 10 years of teaching experience. This trend corresponds to the relatively smaller presence of Millennials (33%) and Generation Z (0%), further emphasizing the older age profile of German educators.

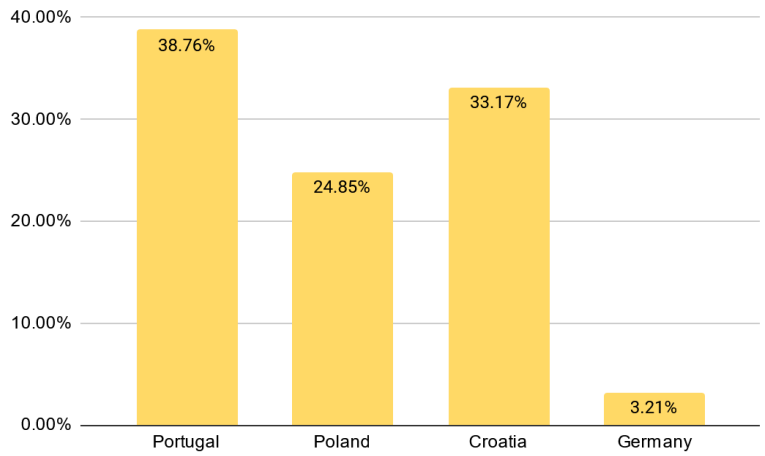

Figure 4: Distribution of respondents per country of residence/teaching

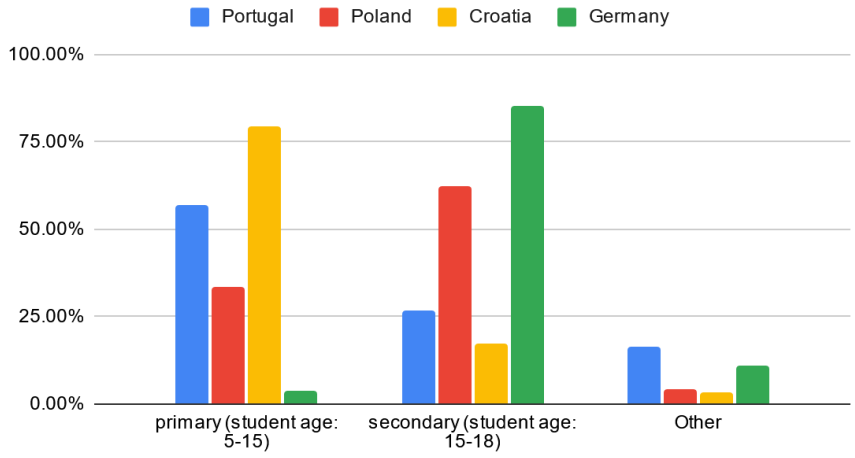

Figure 5: Distribution of respondents per teaching level

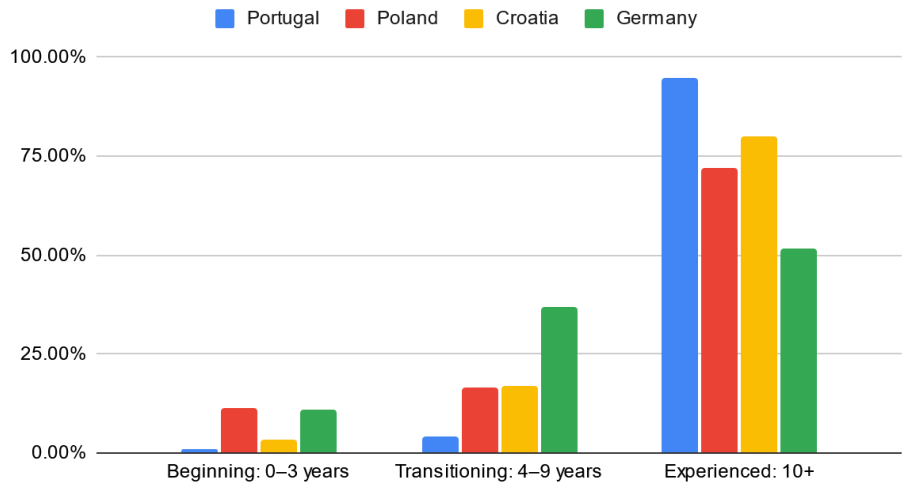

Figure 6: Distribution per teaching experience

Based on the teaching subjects and levels as shown in Figure 6, Humanities and Art, which dominate in Poland (48.57%) and are also prominent in Portugal (38.34%) and Croatia (35.80%), are typically associated with primary education. This reflects the significant representation of primary educators, particularly in Croatia. In contrast, STEM subjects, which have the highest representation in Germany (81.48%) and a substantial share in Croatia (40.43%), suggest a focus on secondary education, as STEM disciplines are often emphasized at higher educational levels. Germany's teaching subject profile stands out, with an overwhelming 81.48% of respondents specialising in STEM disciplines. This is by far the highest proportion among partner countries, suggesting a significant national emphasis on technical and scientific education. The lack of representation in Health and Vocational subjects, as well as the limited share of Humanities and Art (14.81%), highlights a more specialised teaching workforce in Germany.

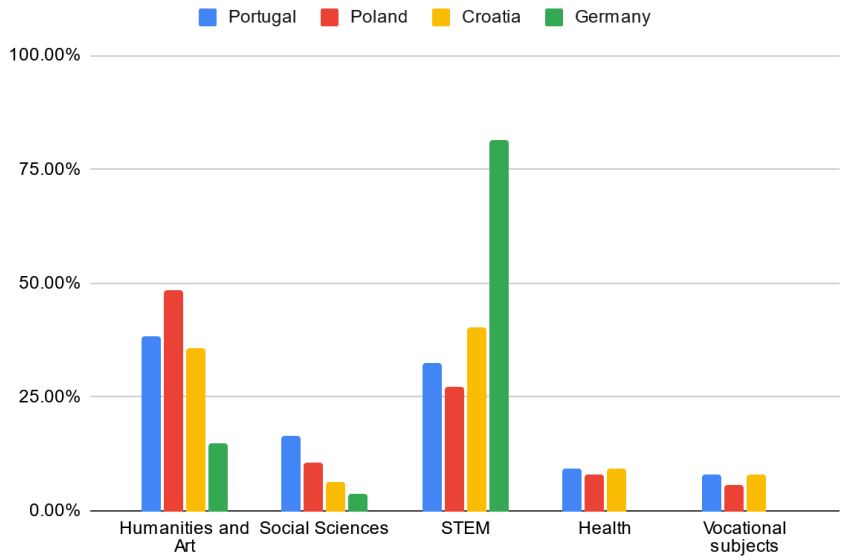

Figure 7: Distribution of respondents per teaching subjects

4.2. Current state of social robots

The integration of robots into educational settings is influenced by several factors, including national guidelines, teacher experience, training, and external obstacles. According to Figure 7, the lack of national or school-level guidelines is a significant barrier across all countries. Portugal demonstrates slightly more progress in this regard, with 10.4% of respondents acknowledging the existence of such guidelines, compared to Germany (7.41%), Poland (6.2%) and Croatia (6.1%).

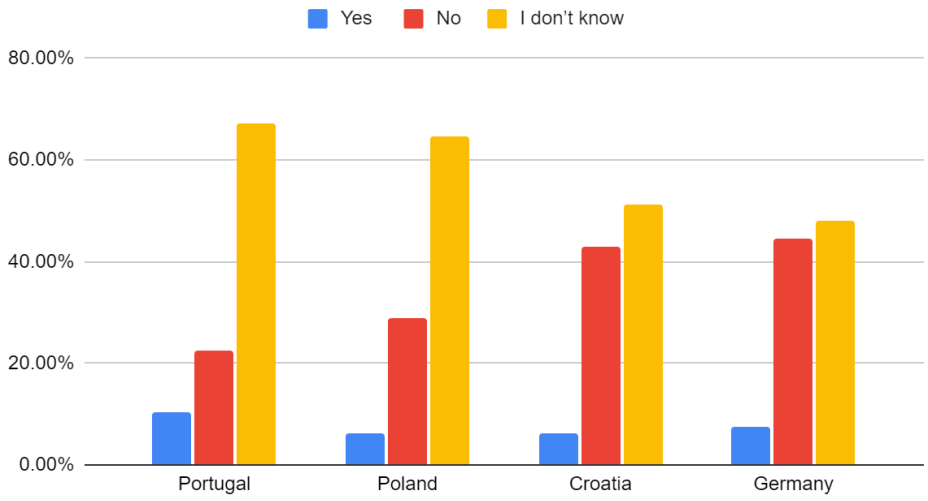

Figure 8: Presence of National/School Guidance on Using Robots in Teaching per country

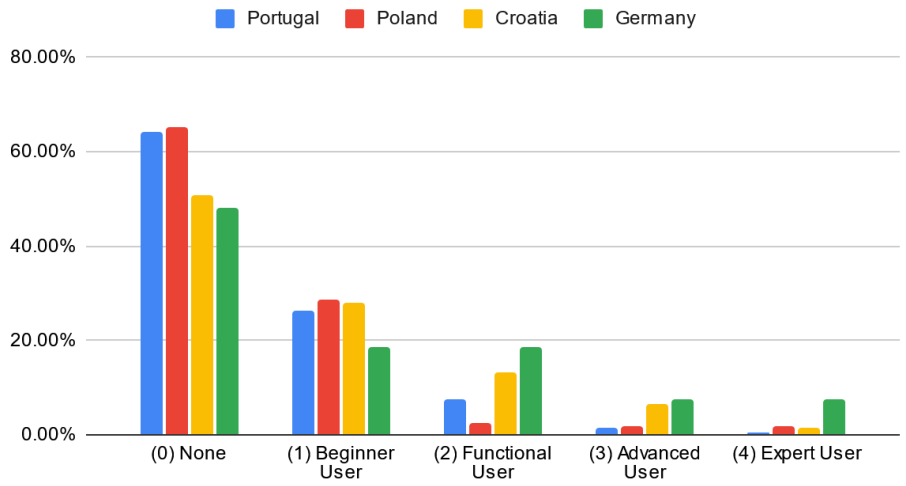

Figure 9: Teachers' Experience with Using Robots in Teaching

Teacher experience with robots (Figure 8) further highlights the inexperience in its adoption and usage. Most educators in Portugal and Poland report no experience (over 64%), while Croatia and Germany show slightly greater engagement, with 13.31% identifying as functional users and 6.47% as advanced users for Croatia and 18.52% identifying as a functional user for Germany and both 7.41% as advanced or expert user for Germany. This aligns with Figure 9, where the frequency of robot use within schools is still limited. A majority of respondents in all countries either report no use or are unaware of usage by their colleagues.

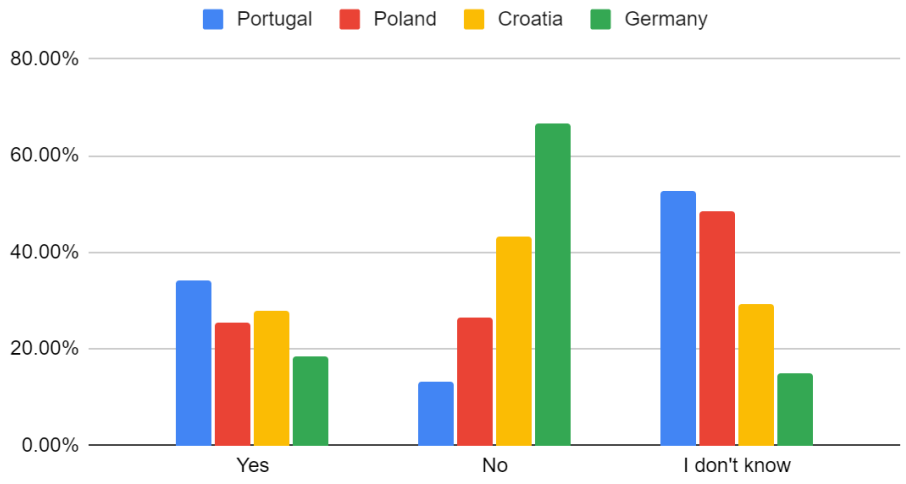

Figure 10: Use of Robots by Other Teachers in the School

Training plays a pivotal role in improving adoption rates. As illustrated in Figure 10, Portugal leads in providing training opportunities, with nearly half (49.84%) of teachers having undergone formal or informal training. In contrast, Poland lags significantly, with only 11.96% of respondents indicating such exposure. Germany follows the trend with only 14.81% training experienced staff, while Croatia falls in between, with a third (33.09%) of teachers reporting some level of training.

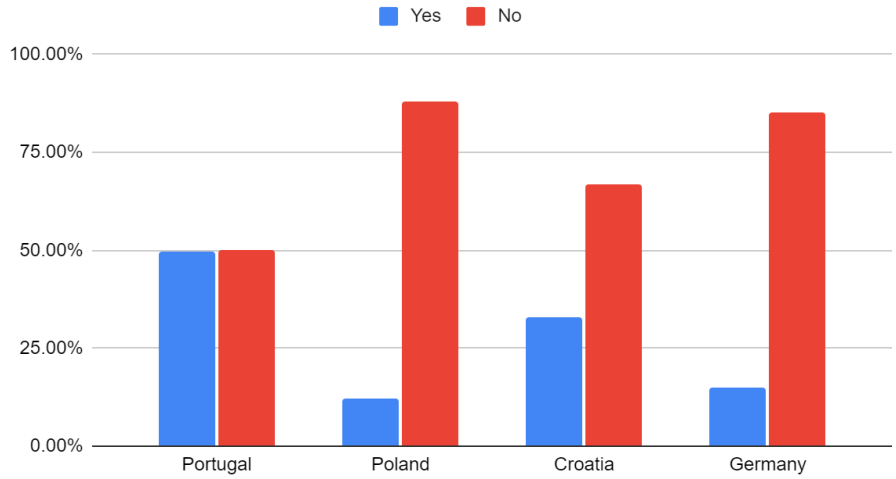

Figure 11: Access to Formal or Informal Training on Using Robots in Teaching

Motivation to use robots in teaching (Figure 11) connected strongly with training availability. German teachers, bolstered by higher engagement levels, express the greatest motivation, with 44.44% indicating either strong or very strong intent, compared to following Croatia (41.37%), Portugal (30.22%) and Poland (39.71%). Overall, the data highlights variations in motivation levels among teachers in Portugal, Poland, Germany and Croatia, with a notable proportion in Germany showing a stronger intent compared to other countries.

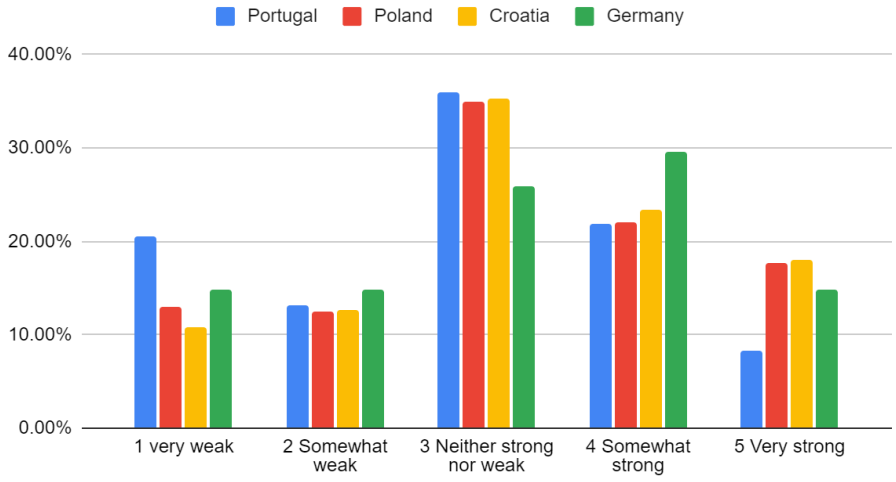

Figure 12: Teachers' Motivation to Use Robots in Teaching

However, external challenges, depicted in Figure 12, persist as significant hurdles. Financial constraints are universally cited, particularly in Croatia, where 82.7% identify cost as a barrier. The lack of training for teachers is another critical obstacle, highlighted by 60.4% of Portuguese respondents and 55% in Croatia. Key barriers differ across countries, with financial costs being the most significant obstacle in Croatia and Germany, while a lack of teacher training is prominent in Germany and Portugal.

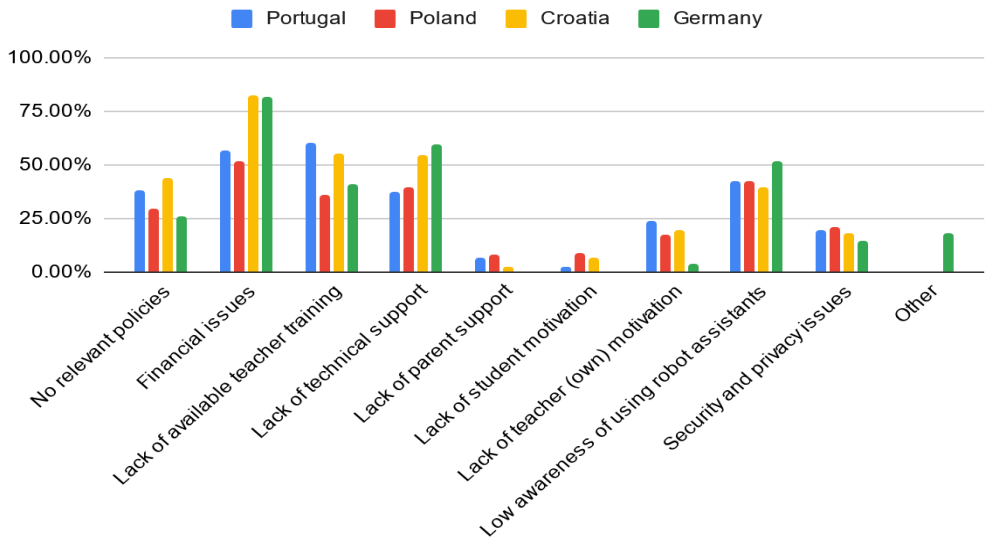

Figure 13: External Obstacles to the Use of Robots in Teaching

Interest in learning to use robots (Figure 13) mirrors motivational patterns, with Croatia again showing the highest levels of strong or very strong interest (51.8%). Teachers in Croatia show relatively higher interest compared to Germany, Poland and Portugal, with a considerable number reporting strong motivation to learn.

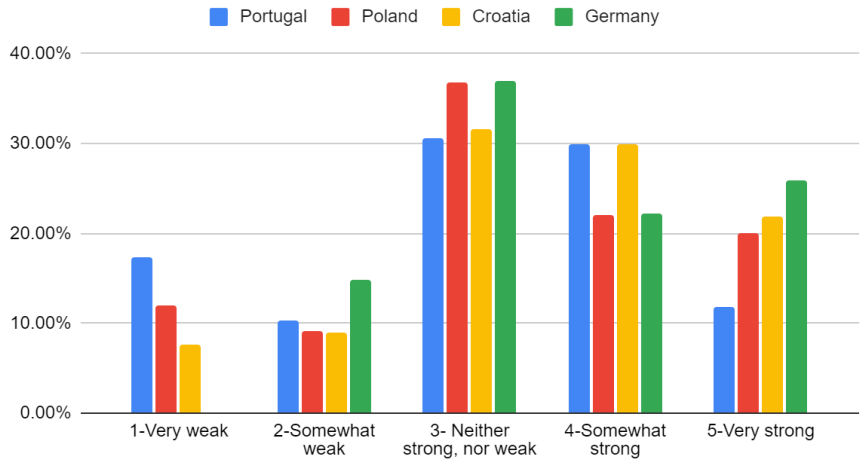

Figure 14: Teachers' Interest in Learning How to Use Robots in Teaching

Training material preferences (Figure 14) further emphasize the importance of practical resources. Croatian educators favor examples of successful case studies (66.9%) and professional development workshops (54.7%), while Portuguese respondents highlight video tutorials (53.7%). German educators struggle to indicate that ready-to-use activities or worksheets for students would be very helpful (62.96%). Overall, there is a strong preference for video tutorials and ready-to-use lesson materials in all countries, with Croatia also showing a notable interest in professional workshops.

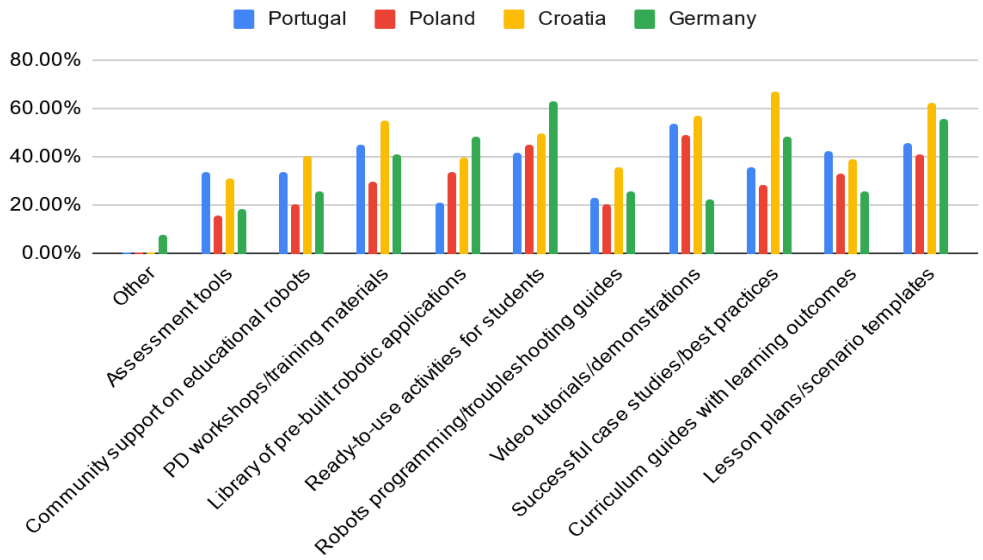

Figure 15: Preferred Training Materials for Using Robots in Teaching

The perceived benefits of using robots in classrooms (Figure 15) vary across countries. While motivational factors dominate in German, Poland and Croatia, inclusivity is a priority for Portuguese educators, reflecting a broader focus on addressing special educational needs. Motivational and practical benefits are most frequently mentioned across all countries, with Croatia particularly valuing motivational aspects, such as promoting interest in STEM.

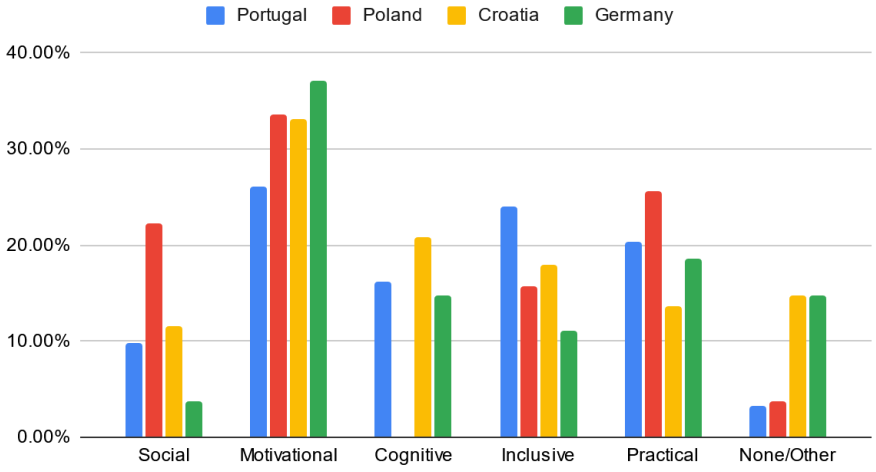

Figure 16: Perceived Benefits of Using Robots in Teaching

Finally, the anticipated reception of robots by students (Figure 16) is overwhelmingly positive, with Croatia leading (80.58% positive responses), followed by Poland (78.47%), Portugal (71.38%) and Germany (66.66%). Students are perceived to respond positively to robots, with the most optimistic outlook reported in Croatia, where the majority of teachers believe students would find them engaging.

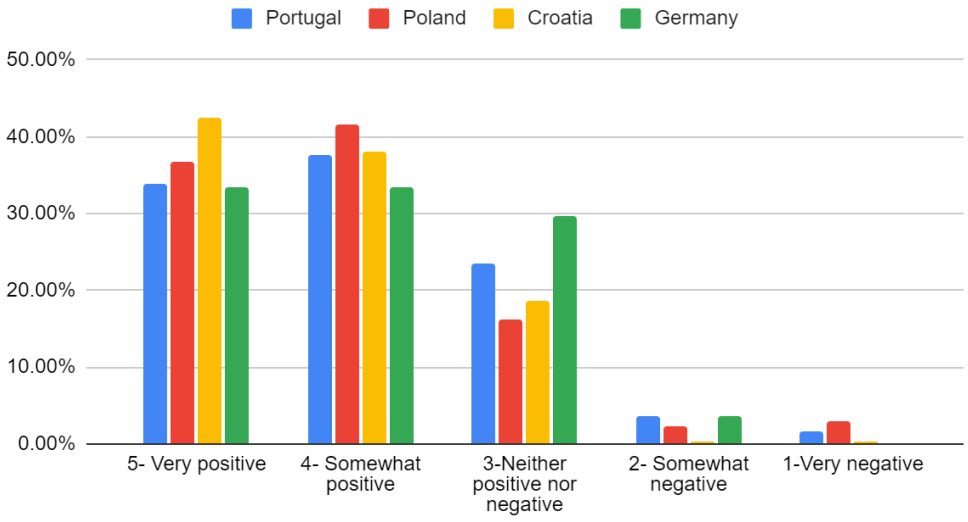

Figure 17: Teachers' Perceptions of Students' Responses to Robots in the Classroom

4.3. Current state of AI

Regarding the presence of national or school guidelines for integrating AI into teaching, the majority of participants in all countries but Germany reported that such guidelines either do not exist or are unknown to them (see Figure 17). When it comes to teachers' experience with using AI, Poland has the highest proportion of those without experience (42.11%), Germany has the highest proportion of expert users, while Croatia and Germany have similarly high proportion leads with a greater percentage of functional and advanced users compared to the other countries (see Figure 18).

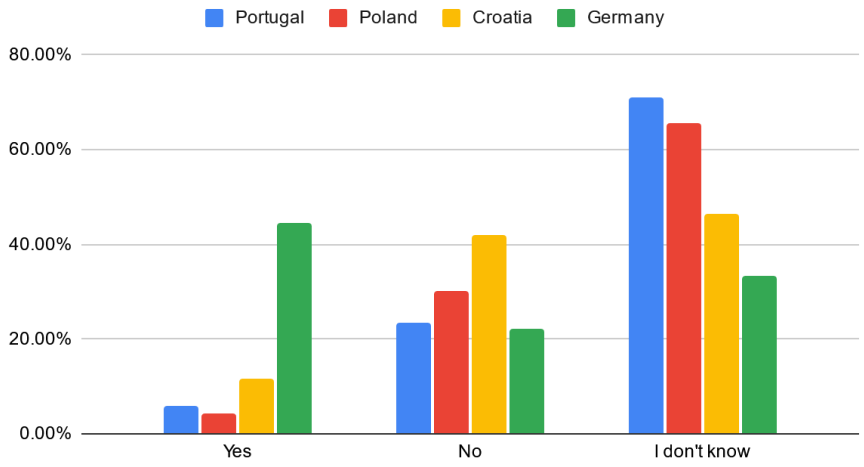

Figure 18: Presence of National/School Guidance on Inclusion of AI in Teaching and Learning per Country

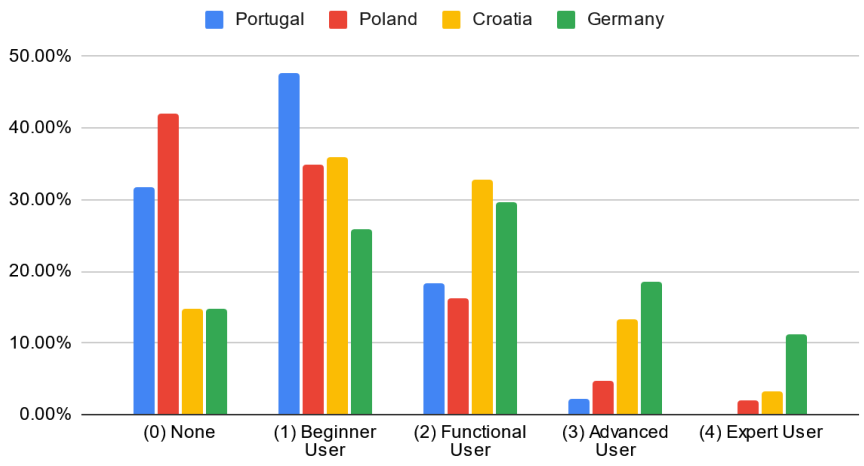

Figure 19: Teachers' Experience with Using AI in Teaching per Country

Furthermore, as for the preferred AI tools for teaching, text-based tools such as ChatGPT and Duolingo are the most popular among teachers in all three countries, with Croatia showing the highest preference rate (87.40%), while interest in lesson planning tools and teacher-parent communication tools is less pronounced. Unlike the three other countries, more than 20% of German respondents stated that they have or would use other AI tools as well (see Figure 19).

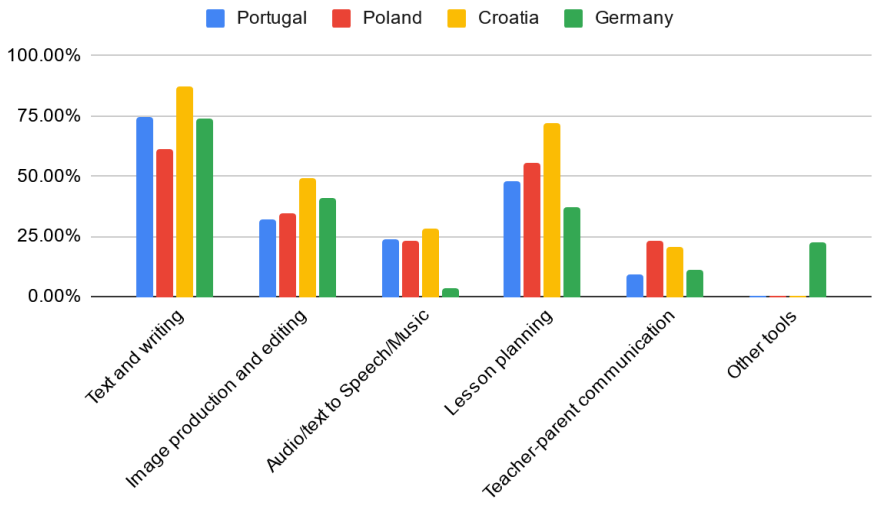

Figure 20: Preferred AI Tools to Use in Teaching per Country

The use of AI by other teachers within the school is most commonly reported in Germany (74.07%), other countries revolving around 40%, which indicates higher level of AI integration in educational systems in Germany (see Figure 20).

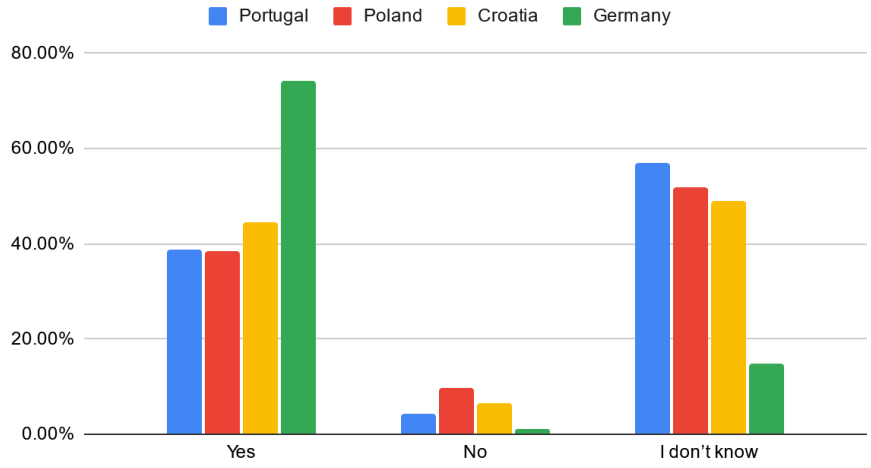

Figure 21: Use of AI by Other Teachers in the School per Country

Although many students reportedly use AI without direct teacher guidance (between 26% and 37% in all four countries), the proportion of those using AI meaningfully under teacher supervision is significantly lower across all countries but Germany. In Portugal, only 7.05% of students are guided by teachers in their use of AI, while Germany shows a much higher figure of 44.44% (see Figure 21). This highlights a significant gap in effective integration of AI into structured learning processes.

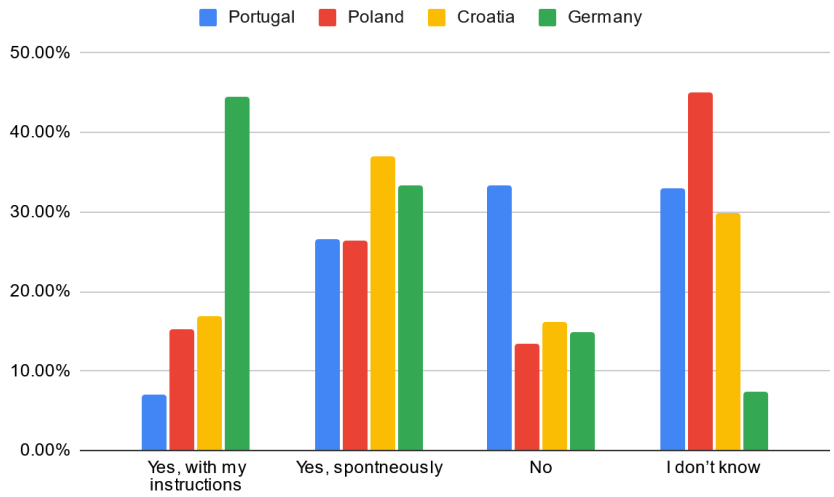

Figure 22: Use of AI for Learning by Students per Country

Formal or informal training for using AI in teaching is most widely available in Portugal and Germany, closely followed by Croatia (ranging from 47% to 59%), while Poland shows significantly lower percentage (see Figure 22). The relatively common availability of training for teachers in Germany, Portugal and Croatia suggests a relatively strong infrastructure for professional development. However, Poland lags behind, with almost 81% of teachers not having access to formal or informal training opportunities.

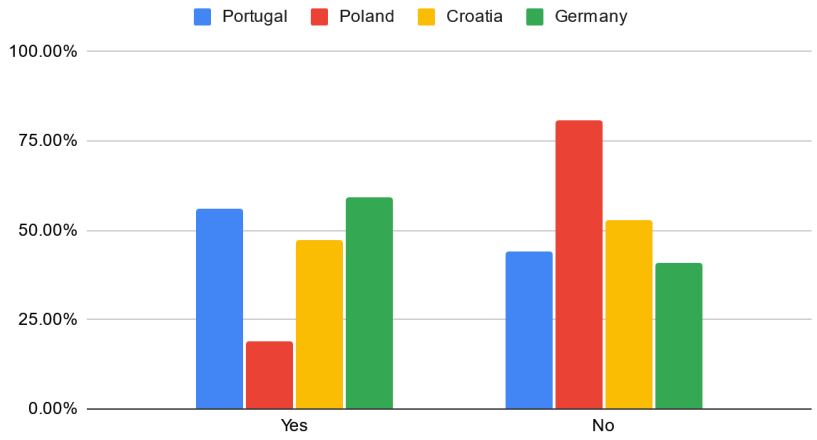

Figure 23: Access to Formal or Informal Training on Using AI in Teaching per Country

The inclusion of students in AI literacy training remains mostly uncommon, although Portugal and Croatia have a relatively high proportion of schools offering such content (see Figure 23), while Germany shows the lowest proportion of all with only 3.7%. Significant number of teachers in Portugal and Poland remain unaware of whether such topics are covered in their schools (15.06% and 23.92%, respectively). This indicates that overall there are opportunities for improvement in promoting awareness of AI literacy.

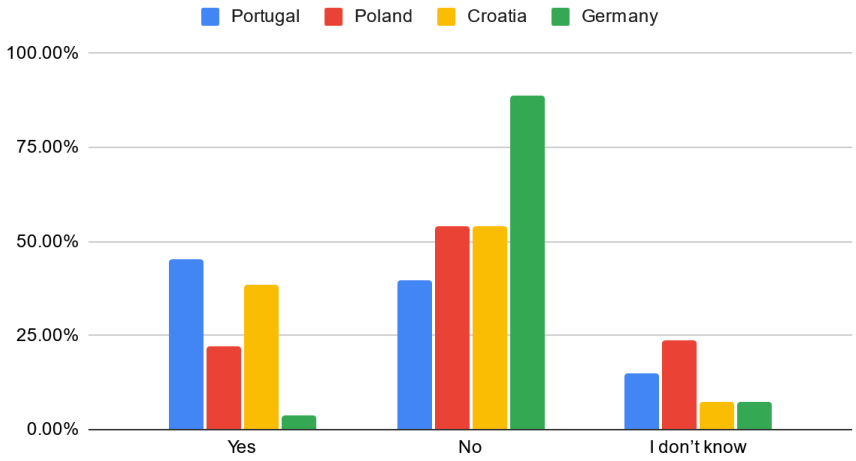

Figure 24: Students' Access to AI Literacy Training per Country

Teachers' motivation to continue using AI in teaching shows positive trends, with Germany and Croatia displaying the strongest motivation, having approximately 70% of teachers reporting "very strong" and "somewhat strong" intentions (see Figure 24). This contrasts with Portugal, where approx. 17% of respondents indicate "weak" and "very weak" motivation, while an additional 34% report as neutral. These findings underline the varying levels of enthusiasm and readiness to adopt AI across different countries.

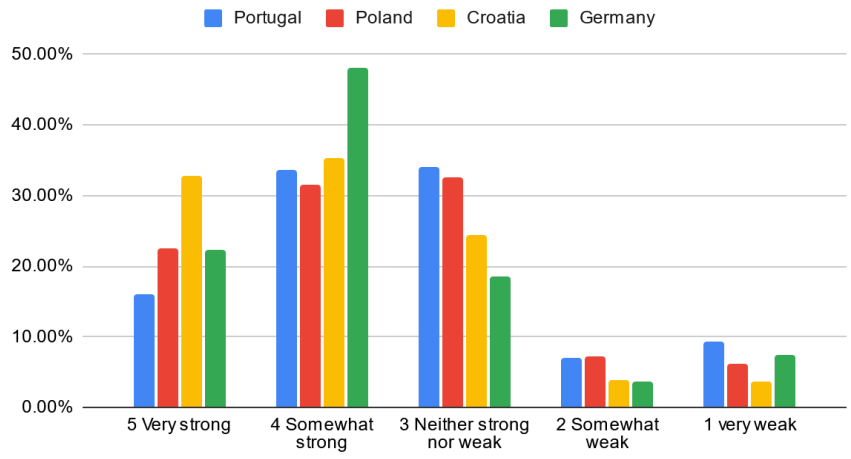

Figure 25: Teachers' Motivation to Use/Continue Using AI in Teaching per Country

However, external obstacles such as the lack of guidelines, training, and technical support remain significant barriers in all four countries (see Figure 25). Additionally, "low awareness of the possible uses of AI" is consistently a top concern, with Croatia showing the highest rate at 58.30%. Similarly, "lack of available training" is a significant barrier in Portugal and Croatia. For Germany, the most significant barrier seems to be "security and privacy issues", as well as “Other” obstacles not mentioned in the survey (22.22%). These challenges suggest that addressing both technical and informational barriers is essential for broader AI adoption.

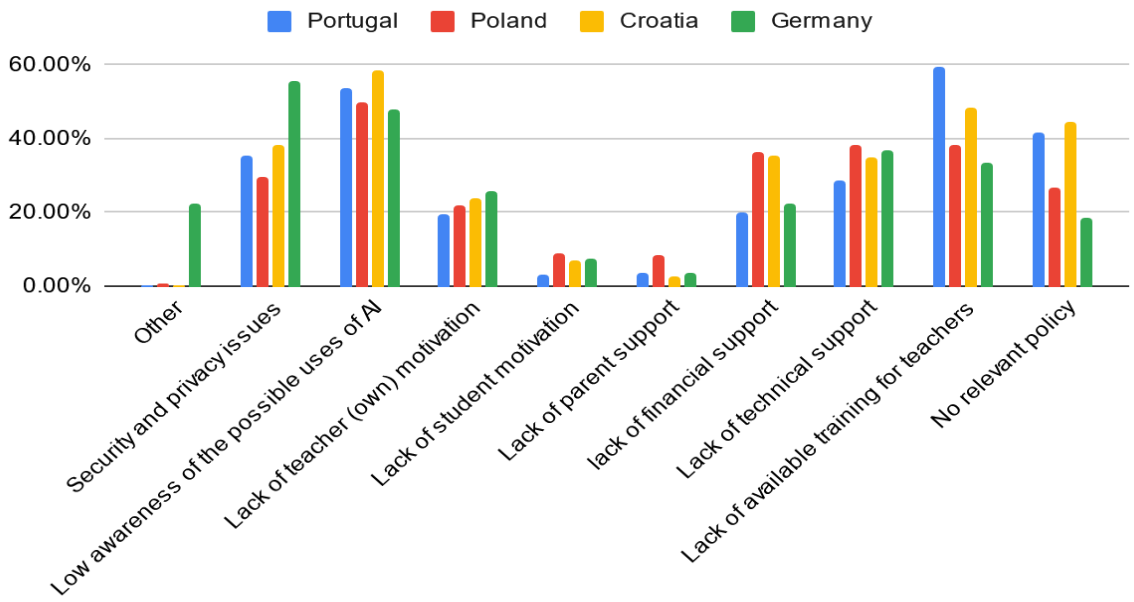

Figure 26: External Obstacles to the Use of AI in Teaching

Despite this, the motivation to learn about AI is high, especially in Croatia and Germany, where respectively approx. 75% and 70% of teachers express either “very strong” and “somewhat strong” interest (see Figure 26). Although at least 50% of respondents in all countries express positive intentions, Germany, Poland and Portugal also show a significantly higher proportion of respondents with “very weak” - approx. 8% compared to approx. 2.5% in Croatia. The variation highlights the need for targeted initiatives to foster interest and engagement in regions and/or demographic groups where motivation is lower.

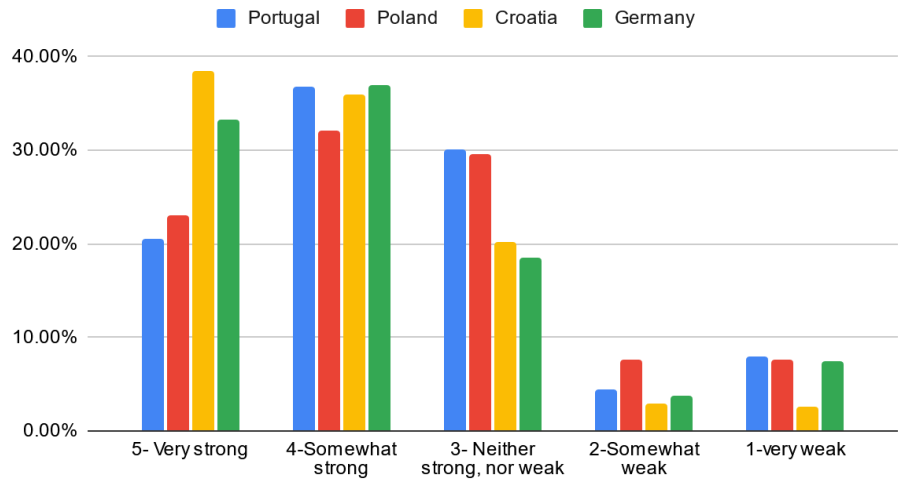

Figure 27: Teachers' Motivation to Learn Using AI in Teaching per Country

Finally, when discussing the benefits of AI in teaching, cognitive benefits, such as providing personalized learning experiences rank highly, reflecting a shared interest across all countries in AI's potential to customize students' learning. Various cognitive benefits and practical benefits (such as reducing workload and improving classroom management) are also consistently rated as the most important in all countries (see Figure 27). Motivational benefits (e.g. enhancing students' motivation) rank highly in Poland, Portugal and Croatia, less so in Germany. These results reflect a shared interest across all countries in AI's potential to drive student interest and participation.

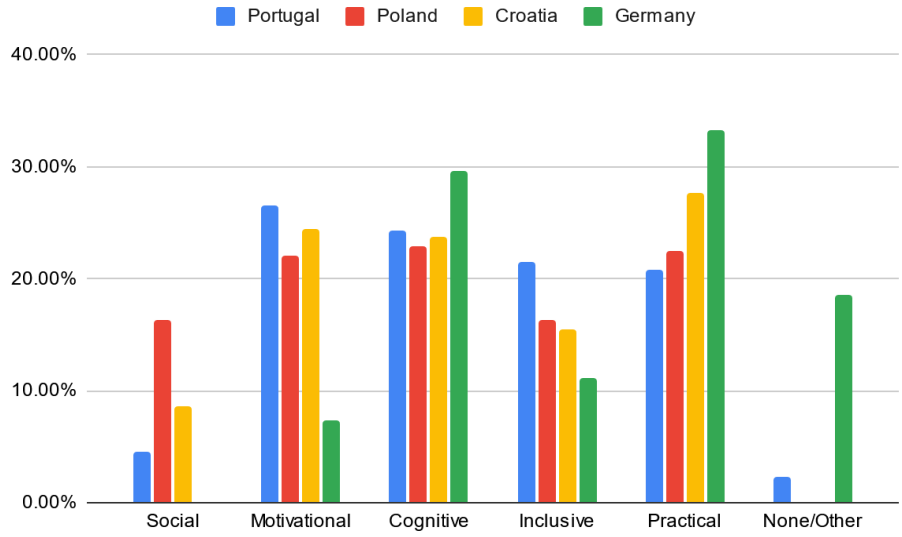

Figure 28: Teachers' Perceived Benefits of AI in Teaching per Country

Teachers' perception of their students' attitudes towards AI in teaching are overwhelmingly positive, particularly in Croatia and Poland, where over 38% of teachers believe students would respond "very positively" (see Figure 28). Germany and Portugal show slightly lower enthusiasm, with a greater percentage of neutral or mixed responses, indicating a potential need for more student-oriented awareness initiatives. These findings indicate substantial potential for further development of AI usage in education, provided there is adequate support and guidance.

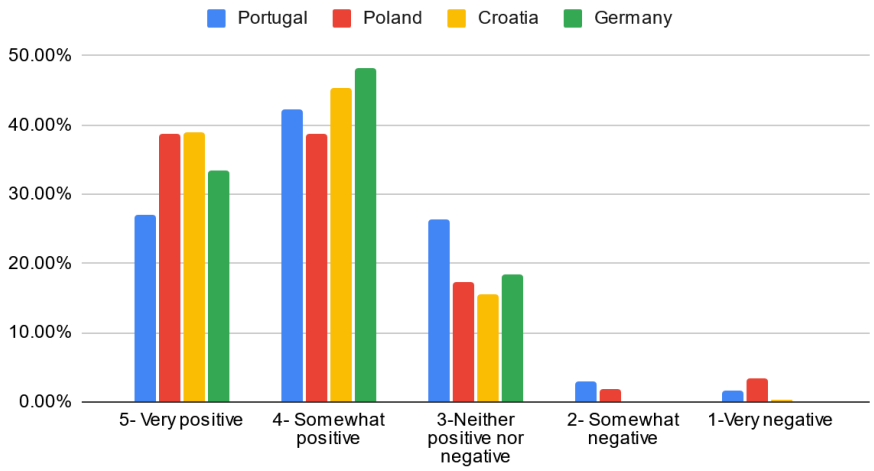

Figure 29: Teachers' Perceptions of Students' Responses to Using AI in the Classroom

5. Conclusion

The findings of this report illuminate the varied landscape of robotics and AI adoption in education within Portugal, Poland, Germany and Croatia. Current results, limited to the sample of teachers who participated in the survey, indicate common challenges such as a lack of national guidelines, financial constraints, and insufficient training resources persist, yet notable progress is evident. From the received data, teachers from Germany and Croatia emerge as leaders in teacher motivation and interest in both robotics and AI, while Portugal demonstrates a strong foundation in training initiatives for robotics. Poland, on the other hand, is marked by a youthful and diverse teaching demographic poised for gradual technological adoption.

The data strongly supports the development of three teacher training modules by highlighting key barriers and needs in integrating humanoid robots into classrooms.

General Introduction to Humanoid Robots – Teachers lack experience and national guidelines, requiring foundational knowledge on the benefits and potential of humanoid robots in education. Motivational factors, especially in Germany and Croatia, indicate a need for introductory materials that emphasize engagement and inclusivity.

Technical Use of Robots – Limited hands-on experience and access to training (especially in Poland and Germany) suggest a need for practical workshops and structured training. Teachers favor video tutorials, ready-to-use materials, and case studies, making blended learning approaches ideal for technical skill development.

Creating Teaching Scenarios – The demand for professional development workshops (Croatia), ready-to-use lesson plans (Germany), and video tutorials (Portugal) indicates that teachers need structured, classroom-ready resources. Scenario-based training should focus on STEM motivation (Croatia) and inclusivity (Portugal) while addressing financial and training barriers across all countries.

This modular approach ensures teachers receive both theoretical and practical support tailored to their specific challenges and preferences.

The emphasis on practical and motivational benefits underscores the transformative potential of these technologies in engaging students and enhancing teaching methodologies. However, the effective realization of these benefits hinges on addressing the critical barriers of financial and technical support, alongside fostering teacher readiness through targeted professional development.

This analysis reaffirms the need for a collaborative approach to policy development, resource allocation, and training to bridge gaps and empower educators to leverage robotics and AI for sustainable and inclusive educational practices. The promising attitudes toward these technologies among students and teachers alike signify an optimistic trajectory, provided systemic support is strengthened across all levels of the educational framework.

With this sense, the next deliverable of this project will be focused to provide teachers and trainers three learning modules which will introduce them to humanoid robotics in education, educate them on how to program those robots for different activities and in the end, how to create teaching scenarios to successfully incorporate humanoid robots in their classes.

Appendix A: Original questionnaire in English language

A/ Demographic questions

1. Your gender

M/F/Non-binary/Prefer to self-describe_____

2. Your age/generation:

- Baby Boomers (born: 1946 to 1964)
- Generation X (born: 1965 to 1980)
- Millennial Generation (born: 1981 to 1996)
- Generation Z (born: 1997 to 2012)

3. Your country of residence/teaching:

4. Your teaching level:

- primary (student age: 5-15)
- secondary (student age: 15-18)
- Other_____

5. Your teaching experience:

- Beginning: 0–3 years
- Transitioning: 4–9 years
- Experienced: 10+

6. Your teaching subject:

- Humanities and Art (languages, drawing, music…)
- Social Sciences (politics, history, geography…)
- STEM (chemistry, informatics, mathematics, physics, science, technical education/engineering)
- Health (physical education, health, medicine …)
- Vocational subjects (specific subjects related to different vocations and practicums)

B/Main Survey

HUMANOID-ROBOTS

What are Humanoid Robots?

Humanoid robots (hereinafter: robots) are a category of social robots designed to interact with humans - in schools, offices, nursing and home. They are equipped with sophisticated human-like facial features, fostering a truly engaging learning environment. They can fulfill various roles, especially the ones related to social interactions. such as teaching assistants, personal tutors, small group leaders, and peer learners. While their prominence is particularly evident

in STEM education, it is noteworthy that robots also exhibit proficiency in disseminating knowledge within humanities disciplines, including language learning. Well known humanoid robots used in education are NAO and Pepper.

1. Is there any national/school document or guideline on how to include robots in teaching and learning?

Yes / No/ I don't know

2. What is your experience with robots in teaching?

- (0) None – I have no experience or knowledge
- (1) Beginner User – I am aware of a topic, but don't have practical experience
- (2) Functional User – I have used robots in classroom
- (3) Advanced User – I have used robots in classroom and I can help others using them
- (4) Expert User – I have used robots and I can teach or train others to use robots

3. Have others in your school ever used robots in teaching?

Yes / No/ I don't know

4. Do you have any (formal or informal) training regarding using robots in teaching?

Yes_____, No

5. On a scale of 1 to 5, how strong would be your intention/motivation to use/continue using robots in teaching?

5 Very strong- 4 Somewhat strong- 3 Neither strong nor weak – 2 Somewhat weak – 1 very weak

6. In your experience what are the most common external obstacles for use of robots in teaching:

- No relevant policy/document/guideline for schools/teachers
- Financial (high purchase and maintenance cost)
- Lack of available training for teachers
- Lack of technical support (necessary infrastructure and repair support)
- Lack of parent support
- Lack of student motivation
- Lack of teacher (own) motivation
- Low awareness of the possible uses of robot assistants
- Security and privacy issues
- Other_____

7. How strong is your interest/motivation to learn how to use robots in teaching?

5- Very strong, 4-Somewhat strong, 3- Neither strong, nor weak, 2-Somewhat weak, 1-very weak

8. What types of training materials would be most helpful for you to design your scenarios to use a robot within your classroom?

(Select all that apply)

- Step-by-step lesson plans or scenario templates
- Curriculum guides aligned with learning outcomes
- Examples of successful case studies or best practices
- Video tutorials or demonstration videos
- Technical guides for programming and troubleshooting robots
- Ready-to-use activities or worksheets for students
- Access to a library of pre-built robotic applications
- Professional development workshops or training materials
- Support from a community of educators using educational robots
- Assessment tools for evaluating student learning outcomes with robots

- Other_____

9. In your opinion, what would be the most important benefit of using robots in your classroom:

- Social (e.g enhancing student engagement and group work; facilitating interactive and hands-on learning…)
- Motivational (e.g enhancing student motivation, promoting interest in STEM…)
- Cognitive (e.g. providing personalized learning experiences; offering new learning opportunities for students (e.g to learn programming and robotics)…)
- Inclusive (e.g. assisting students with special educational needs, supporting students with learning and other difficulties, addressing individual needs of students)
- Practical (e.g reducing teacher workload for repetitive task; improving classroom management and monitoring…)
- None/Other_____

10. On a scale of 1 to 5, according to your opinion, how would students in your classroom respond to having robots?

5- Very positive, 4- Somewhat positive, 3-Neither positive nor negative, 2- Somewhat negative, 1-Very negative

AI in TLA

What is artificial intelligence (AI) in teaching and learning activities (TLA)?

AI broadly refers to large language models (LLMs) designed and programmed to perform cognitive tasks we typically associate with human decision-making and analytical ability. AI in education has several applications, all with the goal of supporting student learning and improving educator efficacy. Recently a subset of AI - generative artificial intelligence (GAI) became widely used in schools by teachers and students (e.g. ChatGPT, Microsoft Copilot, etc.). It specifically focuses on generating content, be it in the form of text, images, music, or other

media. While traditional AI is often about analysis and decision-making based on existing data (like recognizing patterns or making predictions), generative AI is about harnessing creativity and creating content.

1. Is there any national/school document or guideline on how to include AI in teaching and learning?

Yes / No/ I don't know

2. What is your experience with AI in teaching?

- (0) None – I have no experience or knowledge
- (1) Beginner User – I am aware of a topic, but don't have practical experience
- (2) Functional User – I have used AI in teaching
- (3) Advanced User – I have used AI in teaching and I can help others using them
- (4) Expert User – I have used AI and I can teach or train others to use AI

3. Please choose the AI tool(s) you use or would like to use in your teaching:

- Text and writing tools (ChatGPT, Duolingo, Cognii, LanguageTool, Scholarcy…)
- Image production and editing tools (PhotoRoom, Picsart…)
- Audio/text to Speech/Music tools (Speechify, Wellsaid…)
- Lesson planning tools (to teach_, Quizizz, Slidesgo, SchoolAI, Quizlet…)
- Teacher-parent communication and involvement tools
- Other tools _____

4. Have others in your school ever used AI in teaching?

Yes / No/ I don't know

5. Do your students use Ai in their learning?

Yes, according to my instructions for learning/assignments/exam preparation

Yes, but this use is not meaningful/advised by me

No

I don't know

6. Do you have any (formal or informal) training regarding using AI in teaching?

Yes_____/ No

7. Were/Are your students included in any AI literacy classes/topics?

Yes_____/ No/ I don't know

8. On a scale of 1 to 5, how strong would be your intention/motivation to use/continue using AI in teaching?

5 Very strong- 4 Somewhat strong- 3 Neither strong nor weak – 2 Somewhat weak – 1 very weak

9**. In your experience what are the most common external obstacles for use of AI in teaching:**

- No relevant policy/document/guideline for schools/teachers
- Lack of available training for teachers
- Lack of technical support
- lack of financial support
- Lack of parent support
- Lack of student motivation
- Lack of teacher (own) motivation
- Low awareness of the possible uses of AI
- Security and privacy issues
- Other_____

10. How strong is your interest/motivation to learn how to use AI in teaching?

5- Very strong, 4-Somewhat strong, 3- Neither strong, nor weak, 2-Somewhat weak, 1-very weak

11. In your opinion, what would be the most important benefit of using AI in your classroom:

- Social (e.g enhancing student engagement and group work and online collaboration)
- Motivational (e.g enhancing student motivation, promoting interest in STEM, writing…)
- Cognitive (e.g. providing personalized learning experiences; offering new learning opportunities)
- Inclusive (e.g. assisting students with special educational needs, supporting students with learning and other difficulties, addressing individual needs of students)
- Practical (e.g reducing teacher workload for repetitive task; improving classroom management and monitoring…)
- None/Other_____

12. On a scale of 1 to 5, according to your opinion, how would students in your classroom respond to using AI in teaching and learning?

5- Very positive, 4- Somewhat positive, 3-Neither positive nor negative, 2- Somewhat negative, 1-Very negative

Appendix B: Questionnaire in Croatian language

A/ Demografska pitanja

1. Vaš spol

- M/Ž/Nebinarni/Ostalo_____

2. Vaša dob/generacija:

- Baby Boomers (rođeni: 1946. do 1964.)
- Generacija X (rođeni: 1965. do 1980.)
- Milenijalci (rođeni: 1981. do 1996.)
- Generacija Z (rođeni: 1997. do 2012.)

3. Vaša zemlja prebivališta/poučavanja: _____

4. Vaša razina poučavanja:

- osnovna škola (dob učenika: 5-15)
- srednja škola (dob učenika: 15-18)
- Drugo:_____

5. Vaše iskustvo u nastavi:

- Početno: 0–3 godine
- Srednje: 4–9 godina
- Napredno : 10+

6. Vaš nastavni predmet:

- Humanističke znanosti i umjetnost (jezici, likovni, glazba…)
- Društvene znanosti (politika, povijest, geografija…)
- STEM (kemija, informatika, matematika, fizika, znanost, tehničko obrazovanje/inženjerstvo)
- Zdravstvene znanosti (tjelesni odgoj, zdravstvo, medicina…)
- Strukovni predmeti (specifični predmeti vezani uz različita zanimanja i praktikumi…)

B/Upitnik

HUMANOIDNI ROBOTI

Što su humanoidni roboti?

Humanoidni roboti (u tekstu:roboti) su kategorija društvenih robota dizajniranih za interakciju s ljudima - u školama, uredima, bolničkim ustanovama i kod kuće. Opremljeni su sofisticiranim crtama lica poput ljudskih, potičući doista privlačno okruženje za učenje. Mogu ispuniti različite uloge, posebice one vezane uz društvene interakcije kao što su pomoćnici u nastavi, osobni učitelji, voditelji grupnog rada i robo-vršnjaci koji uče. Iako je njihova upotrebe posebno česta u STEM obrazovanju, važno je napomenuti da roboti također pokazuju sposobnost u širenju znanja unutar humanističkih disciplina, uključujući učenje jezika. Dobro poznati humanoidni roboti koji se koriste u obrazovanju su NAO i Pepper.

1. Postoji li nacionalni/školski dokument ili smjernica o tome kako uključiti robote u poučavanje i učenje?

Da / Ne / Ne znam

2. Kakvo je vaše iskustvo s robotima u nastavi?

(0) Bez iskustva – nemam iskustva ni znanja

(1) Korisnik početnik – imam osnovna znanja o temi, ali nemam praktičnog iskustva

(2) Funkcionalni korisnik – koristio_la/koristim robote u učionici

(3) Napredni korisnik – koristio_la/koristim robote u učionici i mogu pomoći drugim korisnicima

(4) Stručnjak – koristio_la/koristim robote i mogu poučavati ili trenirati druge korisnike

3. Jesu li drugi nastavnici u vašoj školi ikada koristili/koriste robote u nastavi?

Da / Ne / Ne znam

4. Imate li kakvo (formalno ili neformalno) obrazovanje u vezi s korištenjem robota u nastavi?

Da_____, Ne

5. Na ljestvici od 1 do 5, koliko bi snažna bila vaša namjera/motivacija da koristite/nastavite koristiti robote u nastavi?

5 Vrlo jaka- 4 Jaka- 3 Ni jaka ni slaba – 2 Slaba – 1 Vrlo slaba

6. Koje su prema vašem iskustvu najčešće prepreke za korištenje robota u nastavi:

- Ne postoji relevantna politika/dokument/smjernice za škole/nastavnike
- Financijske prepreke (visoki troškovi kupnje i održavanja)
- Nedostatak dostupne obuke za nastavnike
- Nedostatak tehničke podrške (potrebna infrastruktura i podrška za popravke)
- Nedostatak podrške roditelja
- Nedostatak motivacije učenika
- Nedostatak (vlastite) motivacije nastavnika
- Niska svijest o mogućim upotrebama robota
- Prepreke vezane za sigurnost i privatnost
- Ostalo_____

7. Koliko je jak vaš interes/motivacija da naučite koristiti robota u nastavi?

5 Vrlo jaka- 4 Jaka- 3 Ni jaka ni slaba – 2 Slaba – 1 Vrlo slaba

8. Koje bi vam vrste materijala za obuku bile od najveće pomoći za osmišljavanje scenarija za korištenje robota pomoćnika u vašoj učionici?

(Odaberite sve primjenjivo)

- Primjeri planova sata ili predlošci scenarija
- Vodiči za kurikulum usklađeni s ishodima učenja
- Primjeri uspješnih praksi
- Video upute ili demonstracijski video zapisi
- Tehnički vodiči za programiranje i rješavanje problema robota
- Aktivnosti ili radni listovi spremni za korištenje za učenike
- Pristup unaprijed izgrađenim robotskim aplikacijama
- Radionice za profesionalni razvoj ili materijali za dodatno obrazovanje
- Podrška nastavnika koji koriste robote
- Alati za vrednovanje učenika pomoću robota
- Ostalo_____

9. Prema vašem mišljenju, koja bi bila najvažnija korist korištenja robota u vašoj učionici:

- Društvena (npr. jačanje angažmana učenika i rada u grupama; omogućavanje interaktivnog i praktičnog učenja...)
- Motivacijska (npr. jačanje motivacije učenika, promicanje interesa za STEM…)
- Kognitivna (npr. pružanje personaliziranih iskustava učenja; ponuda novih mogućnosti učenja za učenike (npr. učenje programiranja i robotike)…)
- Integracijska (npr. pomoć učenicima s posebnim obrazovnim potrebama, podrška učenicima s poteškoćama u učenju i drugim poteškoćama, rješavanje individualnih potreba učenika…)
- Praktična (npr. smanjenje opterećenja nastavnika za zadatke koji se ponavljaju; poboljšanje upravljanja razredom i praćenja...)
- Ništa/drugo_____

10. Na ljestvici od 1 do 5, prema vašem mišljenju, kako bi učenici u vašoj učionici reagirali na robota?

5- Vrlo pozitivno, 4- Pozitivno, 3- Ni pozitivno ni negativno, 2- Negativno, 1-Vrlo negativno

AI u TLA

Što je umjetna inteligencija (AI) u aktivnostima poučavanja i učenja (TLA)?

AI se općenito odnosi na velike jezične modele (LLM) dizajnirane i programirane za obavljanje kognitivnih zadataka koje obično povezujemo s ljudskim donošenjem odluka i analitičkim sposobnostima. AI u obrazovanju ima nekoliko primjena, sve s ciljem podrške učenju i poboljšanja učinkovitosti nastavnika. Nedavno su učitelji i učenici intenzivno počeli koristiti podskup umjetne inteligencije - generativnu umjetnu inteligenciju (GAI). Njezina je posebnost generiranje sadržaja, bilo u obliku teksta, slika, glazbe ili drugih medija (npr. ChatGPT,

Microsoft Copilot, i dr.).mDok se tradicionalna umjetna inteligencija često bavi analizom i donošenjem odluka na temelju postojećih podataka (kao što je prepoznavanje obrazaca ili predviđanja), generativna umjetna inteligencija se bavi iskorištavanjem kreativnosti i stvaranjem sadržaja.

1. Postoji li nacionalni/školski dokument ili smjernice o tome kako uključiti umjetnu inteligenciju u poučavanje i učenje?

Da / Ne / Ne znam

2. Kakvo je vaše iskustvo s umjetnom inteligencijom u nastavi?

(0) Bez iskustva – nemam iskustva ni znanja

(1) Korisnik početnik – imam osnovna znanja o temi, ali nemam praktičnog iskustva

(2) Funkcionalni korisnik – koristio_la sam/koristim AI u nastavi

(3) Napredni korisnik – koristio_la sam/koristim AI u nastavi i mogu pomoći drugim korisnicima

(4) Stručnjak – koristio sam AI i mogu poučavati ili trenirati druge korisnike

3. Odaberite alate umjetne inteligencije koje koristite ili biste ih željeli koristiti u radu:

- Alati za tekst i pisanje (ChatGPT, Duolingo, Cognii, LanguageTool, Scholarcy…)
- Alati za izradu i uređivanje slika (PhotoRoom, Picsart…)
- Pretvaranje audio sadržaja/u tekst /alati za glazbu (Speechify, Wellsaid…)
- Alati za planiranje nastave (to teach_, Quizizz, Slidesgo, SchoolAI, Quizlet…)
- Alati za komunikaciju i uključivanje roditelja
- Ostali alati _____

4. Jesu li drugi nastavnici u vašoj školi ikada koristili/koriste AI u nastavi?

Da / Ne / Ne znam

5. Koriste li vaši učenici AI u svom učenju?

Da, prema mojim uputama za učenje/zadatke/pripremu ispita

Da, ali mimo mojih uputa/savjeta

Ne

Ne znam

6. Imate li kakvo (formalno ili neformalno) obrazovanje u vezi s korištenjem umjetne inteligencije u nastavi?

Da_____/ Ne

7. Jesu li vaši učenici bili uključeni u bilo koju nastavu/temu AI opismenjavanja?

Da_____/ Ne/ Ne znam

8. Na ljestvici od 1 do 5, koliko bi jaka bila vaša namjera/motivacija da koristite/nastavite koristiti AI u nastavi?

5 Vrlo jaka- 4 Jaka- 3 Ni jaka ni slaba – 2 Slaba – 1 Vrlo slaba

9. Prema vašem iskustvu, koje su najčešće prepreke za korištenje umjetne inteligencije u nastavi:

- **Ne postoji relevantna politika/dokument/smjernice za škole/nastavnike**
- **Nedostatak dostupnog obrazovanja za nastavnike**
- **Nedostatak tehničke podrške**
- **Nedostatak financijske potpore**
- **Nedostatak podrške roditelja**
- **Nedostatak motivacije učenika**
- **Nedostatak (vlastite) motivacije nastavnika**
- **Niska svijest o mogućim upotrebama umjetne inteligencije**
- **Prepreke vezane za sigurnost i privatnost**
- **Ostalo_____**

10. Koliko je snažan vaš interes/motivacija da naučite kako koristiti AI u nastavi?

5- Vrlo jaka, 4-Jaka, 3- Ni jaka, ni slaba, 2-Slaba, 1-Vrlo slaba

11. Prema vašem mišljenju, koja bi bila najvažnija korist od korištenja umjetne inteligencije u vašoj učionici:

- **Društvena (npr. jačanje angažmana učenika i rada u grupama; omogućavanje interaktivnog i praktičnog učenja...)**
- **Motivacijska (npr. jačanje motivacije učenika, promicanje interesa za STEM…)**
- **Kognitivna (npr. pružanje personaliziranih iskustava učenja; ponuda novih mogućnosti učenja za učenike (npr. učenje programiranja i robotike)…)**
- **Integracijska (npr. pomoć učenicima s posebnim obrazovnim potrebama, podrška učenicima s poteškoćama u učenju i drugim poteškoćama, rješavanje individualnih potreba učenika…)**
- **Praktična (npr. smanjenje opterećenja nastavnika za zadatke koji se ponavljaju; poboljšanje upravljanja razredom i praćenja...)**
- **Ništa/drugo_____**

12. Na ljestvici od 1 do 5, prema vašem mišljenju, kako bi učenici u vašoj učionici reagirali na korištenje umjetne inteligencije u nastavi i učenju?

5- Vrlo pozitivno, 4- Pozitivno, 3- Ni pozitivno ni negativno, 2- Negativno, 1-Vrlo negativno

Appendix C: Questionnaire in German language

A/ Demografische Fragen

1. Ihr Geschlecht

- **M/F/Nichtbinär/Beschreibung lieber selbst_____**

2. Ihr Alter/Ihre Generation:

- **Babyboomer (geboren: 1946 bis 1964)**
- **Generation X (geboren: 1965 bis 1980)**
- **Millennial-Generation (geboren: 1981 bis 1996)**
- **Generation Z (geboren: 1997 bis 2012)**

3. Ihr Bundesland:

4. Ihre Unterrichtsstufe:

- **Grundschule (Schüleralter: 5-15)**
- **Sekundarstufe (Schüleralter: 15-18)**
- **Sonstiges_____**

5. Ihre Unterrichtserfahrung:

- **Anfang: 0–3 Jahre**
- **Übergang: 4–9 Jahre**
- **Erfahren: 10+**

6. Ihr Unterrichtsfach:

- **Geisteswissenschaften und Kunst (Sprachen, Zeichnen, Musik…)**
- **Sozialwissenschaften (Politik, Geschichte, Geographie…)**
- **MINT (Chemie, Informatik, Mathematik, Physik, Naturwissenschaften, technische Ausbildung/Ingenieurwesen)**
- **Gesundheit (Sport, Gesundheit, Medizin …)**
- **Berufsbezogene Fächer (spezifische Fächer im Zusammenhang mit verschiedenen Berufen und Praktika)**

Humanoide Roboter

Was sind Humanoide Roboter**?**

Humanoide Roboter (im Folgenden: Roboter) sind eine Kategorie sozialer Roboter, die für die Interaktion mit Menschen konzipiert sind – in Schulen, Büros, in der Krankenpflege und zu Hause. Sie sind mit hoch entwickelten, menschenähnlichen Gesichtszügen ausgestattet und fördern eine wirklich ansprechende Lernumgebung. Sie können verschiedene Rollen übernehmen, insbesondere solche, die mit sozialen Interaktionen verbunden sind, wie Lehrassistenten, persönliche Tutoren, Leiter kleiner Gruppen und Peer-Learner. Während ihre Bedeutung besonders im MINT-Unterricht offensichtlich ist, ist es bemerkenswert, dass Roboter auch in der Wissensvermittlung in Geisteswissenschaften, einschließlich des Sprachenlernens, kompetent sind. Bekannte humanoide Roboter, die in der Bildung eingesetzt werden, sind NAO und Pepper.

1. Gibt es ein nationales/schulisches Dokument oder eine Richtlinie zur Einbindung von Robotern in der Bildung?

Ja / Nein / Ich weiß nicht

2. Welche Erfahrungen haben Sie mit Roboter im Unterricht?

(0) Keine – Ich habe keine Erfahrung oder Kenntnisse

(1) Anfänger – Ich kenne mich mit einem Thema aus, habe aber keine praktische Erfahrung

(2) Funktionale/r Nutzer*in – Ich habe Roboter im Unterricht eingesetzt

(3) Fortgeschrittener Benutzer – Ich habe Roboter im Unterricht eingesetzt und kann anderen bei deren Verwendung helfen

(4) Experte – Ich habe Roboter eingesetzt und kann anderen den Einsatz von Robotern beibringen oder sie darin ausbilden

3. Haben andere an Ihrer Schule schon einmal Roboter im Unterricht eingesetzt?

Ja / Nein / Ich weiß nicht

4. Haben Sie eine (formelle oder informelle) Ausbildung zum Einsatz von Roboter im Unterricht?

Ja_____, Nein

5. Wie stark wäre Ihre Absicht/Motivation auf einer Skala von 1 bis 5, Roboter im Unterricht einzusetzen/weiterhin einzusetzen?

5 Sehr stark- 4 Etwas stark- 3 Weder stark noch schwach – 2 Etwas schwach – 1 Sehr schwach

6. Was sind Ihrer Erfahrung nach die häufigsten externen Hindernisse für den Einsatz von Robotern im Unterricht:

- **Keine relevanten Richtlinien/Dokumente/Leitlinien für Schulen/Lehrkräfte**
- **Finanziell (hohe Anschaffungs- und Wartungskosten)**
- **Mangelnde verfügbare Schulungen für Lehrkräfte**
- **Mangelnde technische Unterstützung (notwendige Infrastruktur und Unterstützung bei Reparatur)**
- **Mangelnde Unterstützung durch die Eltern**
- **Mangelnde Motivation der Schüler*innen**
- **Mangelnde (eigene) Motivation der Lehrkräfte**
- **Geringes Bewusstsein für die Einsatzmöglichkeiten von Roboter**
- **Sicherheits- und Datenschutzprobleme**
- **Sonstiges_____**

7. Wie stark ist Ihr Interesse/Ihre Motivation, den Einsatz von Roboter im Unterricht zu erlernen?

5 – Sehr stark, 4 – Eher stark, 3 – Weder stark noch schwach, 2 – Eher schwach, 1 – Sehr schwach

8. Welche Arten von Schulungsmaterialien wären für Sie am hilfreichsten, um Ihre Szenarien für den Einsatz von Robotern in Ihrem Klassenzimmer zu entwerfen?

(Alle zutreffenden auswählen)

- **Schritt-für-Schritt-Unterrichtspläne oder Szenario-Vorlagen**
- **Lehrpläne, die auf Lernergebnisse ausgerichtet sind**
- **Beispiele für erfolgreiche Fallstudien oder bewährte Verfahren**
- **Video-Tutorials oder Demonstrationsvideos**
- **Technische Anleitungen zum Programmieren und zur Fehlerbehebung bei Robotern**
- **Einsatzfertige Aktivitäten oder Arbeitsblätter für Schüler*innen**
- **Zugriff auf eine Bibliothek mit vorgefertigten Roboteranwendungen**
- **Workshops zur beruflichen Weiterbildung oder Schulungsmaterialien**
- **Unterstützung durch eine Community von Pädagogen, die Lernroboter verwenden**
- **Bewertungstools zur Bewertung der Lernergebnisse der Schüler*innen mit Robotern**
- **Sonstiges_____**

9. Was wäre Ihrer Meinung nach der wichtigste Vorteil des Einsatzes von Roboter in Ihrem Unterricht:

- **Sozial (z. B. Verbesserung des Engagements und der Gruppenarbeit der Schüler*innen; Erleichterung des interaktiven und praktischen Lernens…)**
- **Motivation (z. B. Verbesserung der Schülermotivation, Förderung des Interesses an MINT…)**
- **Kognitiv (z. B. Bereitstellung personalisierter Lernerfahrungen; Angebot neuer Lernmöglichkeiten für Schüler*innen (z. B. zum Erlernen von Programmierung und Robotik)…)**
- **Inklusiv (z. B. Unterstützung von Schüler*innen mit besonderen pädagogischen Bedürfnissen, Unterstützung von Schüler*innen mit Lern- und anderen Schwierigkeiten, Berücksichtigung individueller Bedürfnisse von Schüler*innen)**
- **Praktisch (z. B. Reduzierung der Arbeitsbelastung von Lehrern bei sich wiederholenden Aufgaben; Verbesserung der Klassenführung und -überwachung…)**
- **Keine/Sonstiges_____**

10. Wie würden Ihrer Meinung nach die Schüler*innen in Ihrem Klassenzimmer auf einer Skala von 1 bis 5 auf Roboter reagieren?

5- Sehr positiv, 4- Eher positiv, 3- Weder positiv noch negativ, 2- Eher negativ, 1- Sehr negativ

KI in TLA

Was ist Künstliche Intelligenz (KI) in Lehr- und Lernaktivitäten (TLA)?

KI bezieht sich im Allgemeinen auf große Sprachmodelle (LLMs), die entwickelt und programmiert wurden, um kognitive Aufgaben auszuführen, die wir normalerweise mit menschlicher Entscheidungsfindung und analytischen Fähigkeiten assoziieren. KI in der Bildung hat mehrere Anwendungen, alle mit dem Ziel, das Lernen der Schüler*innen zu unterstützen und die Wirksamkeit der Pädagogen zu verbessern. In letzter Zeit wurde eine Untergruppe der KI – generative künstliche Intelligenz (GAI) – in Schulen von Lehrenden und Schüler*innen weithin eingesetzt. Sie konzentriert sich speziell auf die Generierung von Inhalten, sei es in Form von Text, Bildern, Musik oder anderen Medien. Während es bei traditioneller KI oft um Analysen und

Entscheidungsfindung auf der Grundlage vorhandener Daten geht (wie das Erkennen von Mustern oder das Treffen von Vorhersagen), geht es bei generativer KI darum, Kreativität zu nutzen und Inhalte zu erstellen.

1. Gibt es ein nationales/schulisches Dokument oder eine Richtlinie zur Einbeziehung von KI in der Bildung?

Ja / Nein / Ich weiß nicht

2. Welche Erfahrungen haben Sie mit KI im Unterricht?

(0) Keine – Ich habe keine Erfahrung oder Kenntnisse

(1) Anfänger – Ich kenne mich mit einem Thema aus, habe aber keine praktische Erfahrung

(2) Funktionaler Benutzer – Ich habe KI im Unterricht eingesetzt

(3) Fortgeschrittener Benutzer – Ich habe KI im Unterricht eingesetzt und kann anderen bei deren Verwendung helfen

(4) Experte – Ich habe KI eingesetzt und kann anderen den Einsatz von KI beibringen oder sie darin ausbilden

3. Bitte wählen Sie das/die KI-Tool(s) aus, das/die Sie in Ihrem Unterricht verwenden oder verwenden möchten:

- **Text- und Schreib-Tools (ChatGPT, Duolingo, Cognii, LanguageTool, Scholarcy…)**
- **Tools zur Bildproduktion und -bearbeitung (PhotoRoom, Picsart…)**
- **Tools zur Audio-/Text-to-Speech-/Musik-Konvertierung (Speechify, Wellsaid…)**
- **Tools zur Unterrichtsplanung (to teach_, Quizizz, Slidesgo, SchoolAI, Quizlet…)**
- **Tools zur Kommunikation und Einbindung von Lehrern und Eltern**
- **Andere Tools _____**

4. Haben andere an Ihrer Schule schon einmal KI im Unterricht eingesetzt?

Ja / Nein / Ich weiß nicht

5. Verwenden Ihre Schüler*innen KI in Ihrem Unterricht?

- **Ja, gemäß meinen Anweisungen für das Lernen/Aufgaben/Prüfungsvorbereitung**
- **Ja, aber dieser Einsatz ist nicht sinnvoll/von mir nicht empfohlen**
- **Nein**
- **Ich weiß nicht**

6. Haben Sie eine (formelle oder informelle) Schulung zum Einsatz von KI im Unterricht absolviert?

Ja_____/ Nein

7. Nehmen Ihre Schüler*innen an Kursen zu KI teil?

Ja_____/ Nein/ Ich weiß nicht

8. Wie stark wäre Ihre Absicht/Motivation auf einer Skala von 1 bis 5, KI im Unterricht einzusetzen/weiterhin einzusetzen?

5 Sehr stark- 4 Etwas stark- 3 Weder stark noch schwach – 2 Etwas schwach – 1 Sehr schwach

9. Was sind Ihrer Erfahrung nach die häufigsten externen Hindernisse für den Einsatz von KI im Unterricht:

- **Keine relevanten Richtlinien/Dokumente/Leitlinien für Schulen/Lehrkräfte**
- **Mangelnde verfügbare Schulungen für Lehrkräfte**
- **Mangelnde technische Unterstützung**
- **Mangelnde finanzielle Unterstützung**
- **Mangelnde Unterstützung durch die Eltern**
- **Mangelnde Motivation der Schüler*innen**
- **Mangelnde (eigene) Motivation der Lehrkräfte**
- **Geringes Bewusstsein für die Einsatzmöglichkeiten von KI**
- **Sicherheits- und Datenschutzprobleme**
- **Sonstiges_____**

10. Wie stark ist Ihr Interesse/Ihre Motivation, den Einsatz von KI im Unterricht zu erlernen?

5- Sehr stark, 4- Eher stark, 3- Weder stark noch schwach, 2- Eher schwach, 1- Sehr schwach

11. Was wäre Ihrer Meinung nach der wichtigste Vorteil des Einsatzes von KI in Ihrem Unterricht:

- **Sozial (z. B. Verbesserung des Engagements der Schüler*innen und der Gruppenarbeit und der Online-Zusammenarbeit)**
- **Motivation (z. B. Verbesserung der Schülermotivation, Förderung des Interesses an MINT, Schreiben…)**
- **Kognitiv (z. B. Bereitstellung personalisierter Lernerfahrungen; Angebot neuer Lernmöglichkeiten)**
- **Inklusiv (z. B. Unterstützung von Schüler*innen mit besonderen pädagogischen Bedürfnissen, Unterstützung von Schüler*innen mit Lern- und anderen Schwierigkeiten, Berücksichtigung individueller Bedürfnisse von Schüler*innen)**
- **Praktisch (z. B. Reduzierung der Arbeitsbelastung der Lehrer bei sich wiederholenden Aufgaben; Verbesserung der Klassenführung und -überwachung…)**
- **Keine/Sonstiges_____**

12. Wie würden Ihrer Meinung nach die Schüler*innen in Ihrem Unterricht auf einer Skala von 1 bis 5 auf den Einsatz von KI in Lehre und Lernen reagieren?

5 – Sehr positiv, 4 – Eher positiv, 3 – Weder positiv noch negativ, 2 – Eher negativ, 1 – Sehr negativ

Appendix D: Questionnaire in Polish language

A/ Pytania demograficzne

1. Twoja płeć
   - M/K/Niebinarny/Wolę opisać siebie _____

2. Twój wiek/pokolenie:
   - Pokolenie wyżu demograficznego (urodzeni: 1946–1964)
   - Pokolenie X (urodzeni: 1965–1980)
   - Pokolenie Millenialsów (urodzeni: 1981–1996)
   - Pokolenie Z (urodzeni: 1997–2012)
   -

3. Kraj zamieszkania/nauczania:

4. Poziom nauczania:
   - podstawowy (wiek ucznia: 5–15)
   - średni (wiek ucznia: 15–18)
   - Inne_____

5. Twoje doświadczenie w nauczaniu:
   - Początkujący: 0–3 lata
   - Średniozaawansowany: : 4–9 lat
   - Doświadczony: 10+

6. Przedmiot nauczania:
   - Nauki humanistyczne i sztuka (języki, rysunek, muzyka…)
   - Nauki społeczne (polityka, historia, geografia…)
   - STEM (chemia, informatyka, matematyka, fizyka, nauki ścisłe, edukacja techniczna/inżynieria)
   - Zdrowie (wychowanie fizyczne, zdrowie, medycyna…)
   - Przedmioty zawodowe (przedmioty szczegółowe związane z różnymi zawodami i praktykami)

B/Kwestionariusz ankiety

Roboty humanoidalne

Roboty humanoidalne (dalej: roboty) to kategoria robotów towarzyszących zaprojektowanych do interakcji z ludźmi - w szkołach, biurach, ośrodkach opiekuńczych i domach. Posiadają zaawansowane układy, rysy twarzy przypominające ludzkie, co sprzyja prawdziwie angażującemu środowisku nauki. Mogą pełnić różne role, zwłaszcza te związane z interakcjami społecznymi, takie jak asystenci nauczycieli, korepetytorzy, liderzy małych grup i członkowie grup rówieśniczych. Chociaż ich wybitna rola jest szczególnie widoczna w edukacji STEM, warto zauważyć, że roboty wykazują również biegłość w rozpowszechnianiu wiedzy w ramach dyscyplin humanistycznych, w tym nauki języków. Powszechnie znane roboty humanoidalne, wykorzystywane w edukacji, to NAO i Pepper.

1. Czy istnieje krajowy/szkolny dokument lub wytyczne dotyczące tego, jak włączyć roboty do nauczania i uczenia się?

Tak / Nie / Nie wiem

2. Jakie masz doświadczenie z robotami w nauczaniu?

(0) Brak – nie mam doświadczenia ani wiedzy

(1) Użytkownik początkujący – znam temat, ale nie mam praktycznego doświadczenia

(2) Użytkownik praktyczny – używałem robotów w klasie

(3) Użytkownik zaawansowany – używałem robotów w klasie i mogę pomóc innym w ich używaniu

(4) Użytkownik ekspert – używałem robotów i mogę uczyć lub szkolić innych w zakresie korzystania z robotów

3. Czy inni w Twojej szkole kiedykolwiek używali robotów w nauczaniu?

Tak / Nie / Nie wiem

4. Czy odbyłeś/aś (formalne lub nieformalne) szkolenie dotyczące korzystania z robotów w nauczaniu?

Tak_____, Nie

5. W skali od 1 do 5, jak silna byłaby Twoja chęć/motywacja do korzystania/kontynuowania wykorzystania robotów w nauczaniu?

5 Bardzo silna - 4 Raczej silna - 3 Ani silna, ani słaba - 2 Raczej słaba - 1 Bardzo słaba

6. Jakie są, według Twojego doświadczenia, najczęstsze zewnętrzne przeszkody w korzystaniu z robotów w nauczaniu:

Brak odpowiedniej polityki/dokumentu/wytycznych dla szkół/nauczycieli

Finansowe (wysokie koszty zakupu i utrzymania)

Brak dostępnych szkoleń dla nauczycieli

Brak wsparcia technicznego (niezbędnej infrastruktury i wsparcia technicznego)

Brak wsparcia rodziców

Brak motywacji uczniów

Brak motywacji nauczyciela (własnej)

Niska świadomość możliwych zastosowań robotów

Kwestie bezpieczeństwa i prywatności

Inne_____

7. Jak silna jest Twoja chęć/motywacja do nauki korzystania z robotów w nauczaniu? 5- Bardzo silna, 4- Raczej silna, 3- Ani silna, ani słaba, 2- Raczej słaba, 1- Bardzo słaba

8. Jakie rodzaje materiałów szkoleniowych byłyby dla Ciebie najbardziej pomocne w projektowaniu scenariuszy do wykorzystania asystenta robota w Twojej klasie?

(Zaznacz wszystkie właściwe)

- **Plany lekcji krok po kroku lub szablony scenariuszy**
- **Przewodniki po programie nauczania dostosowane do rezultatów uczenia się**
- **Przykłady sprawdzonych studiów przypadków lub najlepszych praktyk**
- **Samouczki wideo lub filmy demonstracyjne**
- **Przewodniki techniczne dotyczące programowania i rozwiązywania problemów z robotami**
- **Gotowe do narzędzia lub karty pracy dla uczniów**
- **Dostęp do biblioteki gotowych aplikacji robotycznych**
- **Warsztaty rozwoju zawodowego lub materiały szkoleniowe**
- **Wsparcie ze strony społeczności nauczycieli korzystających z robotów edukacyjnych**
- **Narzędzia oceny do oceny rezultatów uczenia się uczniów za pomocą robotów**
- **Inne_____**

9. Jaka jest Twoim zdaniem najważniejsza korzyść z korzystania z robotów w Twojej klasie:

- **Społeczna (np. zwiększanie zaangażowania uczniów i pracy grupowej; ułatwianie interaktywnej i praktycznej nauki…)**
- **Motywacyjna (np. zwiększanie motywacji uczniów, promowanie zainteresowania naukami ścisłymi, technicznymi, technicznymi, matematycznymi, matematycznymi, matematycznymi, przyrodniczymi, uczeniem się programowania i robotyki …)**
- **Inkluzywne (np. pomaganie uczniom ze specjalnymi potrzebami edukacyjnymi, wspieranie uczniów z trudnościami w nauce i innymi trudnościami, zaspokajanie indywidualnych potrzeb uczniów)**
- **Praktyczne (np. zmniejszanie obciążenia nauczyciela powtarzalnymi zadaniami; poprawa zarządzania klasą i monitorowania…)**
- **Brak/Inne_____**

10. W skali od 1 do 5, według Twojej opinii, jak uczniowie w Twojej klasie zareagowaliby na obecność robotów?

5- Bardzo pozytywnie, 4- Raczej pozytywnie, 3- Ani pozytywnie, ani negatywnie, 2- Raczej negatywnie, 1- Bardzo negatywnie

AI w TLA

Czym jest sztuczna inteligencja (AI) w nauczaniu i uczeniu się (TLA)?

AI ogólnie odnosi się do dużych modeli językowych (LLM) zaprojektowanych i zaprogramowanych do wykonywania zadań poznawczych, które zazwyczaj kojarzymy z ludzkim podejmowaniem decyzji i zdolnością analityczną. AI w edukacji ma kilka zastosowań, wszystkie służą wspieraniu procesu uczenia się uczniów i poprawie skuteczności pracy nauczycieli. Niedawno podzbiór AI - generatywna sztuczna inteligencja (GAI) stała się szeroko stosowana w szkołach przez nauczycieli i uczniów. Koncentruje się ona konkretnie na generowaniu

treści, czy to w formie tekstu, obrazów, muzyki czy innych mediów. Podczas gdy tradycyjna AI często dotyczy analizy i podejmowania decyzji w oparciu o istniejące dane (takie jak rozpoznawanie wzorców lub dokonywanie przewidywań), generatywna AI dotyczy wykorzystywania kreatywności i tworzenia treści.

1. Czy istnieje krajowy/szkolny dokument lub wytyczne dotyczące tego, jak włączyć AI do nauczania i uczenia się?

Tak / Nie / Nie wiem

2. Jakie masz doświadczenie z AI w nauczaniu?

(0) Brak – nie mam doświadczenia ani wiedzy

(1) Użytkownik początkujący – znam temat, ale nie mam praktycznego doświadczenia

(2) Użytkownik praktyczny– używałem AI w nauczaniu

(3) Użytkownik zaawansowany – używałem AI w nauczaniu i mogę pomóc innym w ich używaniu

(4) Użytkownik ekspert – używałem AI i mogę uczyć lub szkolić innych w zakresie używania AI

3. Wybierz narzędzia AI, których używasz lub chciałbyś używać w nauczaniu:

- **Narzędzia do pisania i pisania (ChatGPT, Duolingo, Cognii, LanguageTool, Scholarcy…)**
- **Narzędzia do tworzenia i edycji obrazów (PhotoRoom, Picsart…)**
- **Narzędzia do konwersji audio/tekstu na mowę/muzykę (Speechify, Wellsaid…)**
- **Narzędzia do planowania lekcji (to teach_, Quizizz, Slidesgo, SchoolAI, Quizlet…)**
- **Narzędzia do komunikacji i interakcji nauczyciela z rodzicami**
- **Inne narzędzia _____**

4. Czy inni w Twojej szkole kiedykolwiek używali AI w nauczaniu?

Tak / Nie / Nie wiem

5. Czy Twoi uczniowie wykorzystują AI w swojej nauce?

- **Tak, zgodnie z moimi instrukcjami dotyczącymi nauki/zadań/przygotowania do egzaminów**
- **Tak, ale to wykorzystanie nie jest sensowne/zalecane przeze mnie**
- **Nie**
- **Nie wiem**

6. Czy odbyłeś/aś (formalne lub nieformalne) szkolenie dotyczące wykorzystania AI w nauczaniu?

Tak_____/ Nie

7. Czy Twoi uczniowie byli/są włączeni w jakieś zajęcia/tematy dotyczące umiejętności posługiwania się AI?

Tak_____/ Nie/ Nie wiem

8. W skali od 1 do 5, jak silna byłaby Twoja chęć /motywacja do wykorzystania/kontynuowania wykorzystania AI w nauczaniu? 5 Bardzo silna- 4 Raczej silna- 3 Ani silna, ani słaba – 2 Raczej słaba – 1 bardzo słaba

9. Jakie są według Ciebie najczęstsze zewnętrzne przeszkody w stosowaniu AI w nauczaniu:

- **Brak odpowiedniej polityki/dokumentu/wytycznych dla szkół/nauczycieli**
- **Brak dostępnych szkoleń dla nauczycieli**
- **Brak wsparcia technicznego**
- **Brak wsparcia finansowego**
- **Brak wsparcia rodziców**
- **Brak motywacji uczniów**
- **Brak motywacji nauczyciela (własnej)**
- **Niska świadomość możliwych zastosowań AI**
- **Kwestie bezpieczeństwa i prywatności**
- **Inne_____**

10. Jak silne jest Twoje zainteresowanie/motywacja do nauki, jak stosować AI w nauczaniu? 5- Bardzo silne, 4- Raczej silne, 3- Ani silne, ani słabe, 2- Raczej słabe, 1- Bardzo słabe

11. Twoim zdaniem, jaka byłaby najważniejsza korzyść z wykorzystania AI w Twojej klasie:

- **Społeczna (np. zwiększenie zaangażowania uczniów, pracy grupowej i współpracy online)**
- **Motywacyjna (np. zwiększenie motywacji uczniów, promowanie zainteresowania STEM, pisaniem…)**
- **Poznawcza (np. zapewnienie spersonalizowanych doświadczeń edukacyjnych; oferowanie nowych możliwości uczenia się)**
- **Inkluzywna (np. pomoc uczniom ze specjalnymi potrzebami edukacyjnymi, wspieranie uczniów z trudnościami w nauce i innymi trudnościami, zaspokajanie indywidualnych potrzeb uczniów)**
- **Praktyczna (np. zmniejszenie obciążenia nauczyciela powtarzalnymi zadaniami; poprawa zarządzania klasą i monitorowania…)**
- **Brak/Inne_____**

12. W skali od 1 do 5, według Twojej opinii, jak uczniowie w Twojej klasie zareagowaliby na wykorzystanie AI w nauczaniu i uczeniu się?

5- Bardzo pozytywne, 4- Raczej pozytywne, 3- Ani pozytywne, ani negatywne, 2- Raczej negatywne, 1- Bardzo negatywne

Appendix E: Questionnaire in Portuguese language

A/ Caracterização sociodemográfica

1. Género
   - M/F/Não binário/Prefere auto-descrever-se _____

2. Idade/geração:
   - Baby Boomers (nascidos: 1946 a 1964)
   - Geração X (nascidos: 1965 a 1980)
   - Geração Millennial (nascidos: 1981 a 1996)
   - Geração Z (nascidos: 1997 a 2012)

3. País de residência/ensino:

4. Nível de ensino:
   - Básico (idade dos alunos: 5-15)
   - Secundário (idade dos alunos: 15-18)
   - Outro_____

5. Anos de experiência de ensino:
   - Início: 0 – 3 anos
   - Intermédia: 4 – 9 anos
   - Experiente: 10 +

6. Área de ensino:
   - Humanidades e Arte (linguagens, desenho, música…)
   - Ciências Sociais (política, história, geografia…)
   - STEM (química, informática, matemática, física, biologia, ensino técnico/engenharia)
   - Saúde/Desporto (educação física, saúde, medicina…)
   - Disciplinas vocacionais (disciplinas específicas relacionadas com diferentes profissões e formações práticas)

B/Questionário

Robôs humanóides

O que são robôs humanóides?

Os robôs humanóides (adiante designados: robôs) são uma categoria de robôs sociais concebidos para interagir com os humanos - em escolas, escritórios, enfermarias e em casa. Estão equipados com sofisticados recursos faciais semelhantes aos humanos, promovendo um ambiente de aprendizagem verdadeiramente envolvente. Podem cumprir diversas funções, principalmente as relacionadas com as interações sociais, como assistentes de ensino, tutores pessoais, líderes de pequenos grupos e pares. Embora a sua relevância seja particularmente evidente na educação STEM, é digno de nota que os robôs também apresentam proficiência na disseminação de conhecimento nas disciplinas de humanidades, incluindo a aprendizagem de línguas. Os Robôs mais conhecidos e utilizados na educação são o NAO e o Pepper.

1. Existe algum documento ou orientação nacional/escolar sobre como incluir os robôs no ensino e na aprendizagem?

Sim / Não / não sei

2. Qual a sua experiência com robôs no ensino?

- (0) Nenhuma – não tenho experiência nem conhecimento
- (1) Utilizador iniciante – Conheço o tema, mas não tenho experiência prática
- (2) Utilizador funcional – utilizei robôs em sala de aula
- (3) Utilizador avançado – utilizei robôs na sala de aula e posso ajudar outras pessoas a utilizá-los
- (4) Utilizador especialista – utilizei robôs e posso ensinar ou formar outras pessoas para utilizarem robôs

3. Existem pessoas na sua escola que já utilizaram robôs no ensino?

Sim / Não / não sei

4. Tem alguma formação (formal ou informal) sobre o uso de robôs no ensino? (Se a resposta for sim, explique.)

Sim _____, Não

5. Numa escala de 1 a 5, quão forte seria a sua intenção/motivação para utilizar/continuar a utilizar robôs-assistentes no ensino?

5 Muito forte – 4 Um pouco forte – 3 Nem forte nem fraca – 2 Um pouco fraca – 1 muito fraca

6. Na sua experiência, quais são os obstáculos externos mais comuns à utilização de robôs no ensino:

- Sem normativo/documento/orientação relevante para escolas/professores
- Financeiro (custo de compra e manutenção elevado)
- Falta de formação disponível para os professores
- Falta de suporte técnico (infraestrutura necessária e suporte de reparação)
- Falta de apoio dos Encarregados de Educação
- Falta de motivação dos alunos
- Falta de motivação (própria) do professor
- Baixa consciência dos possíveis usos dos assistentes robóticos
- Questões de segurança e privacidade
- Outro_____

7. Quão forte é o seu interesse/motivação para aprender a utilizar robôs no ensino?

5- Muito forte, 4- Um pouco forte, 3- Nem forte nem fraco, 2- Um pouco fraco, 1-muito fraco

8. Que tipos de materiais de formação seriam mais úteis para conceber os seus cenários para utilizar o assistente robô na sua sala de aula?

(Selecione todas as opções aplicáveis)

- Planos de aula detalhados ou exemplos de cenários de aprendizagem
- Orientações curriculares alinhadas com objetivos de aprendizagem
- Exemplos de sucesso de estudos de caso ou práticas recomendadas
- Tutoriais em vídeo ou vídeos de demonstração
- Manuais técnicos para programação e resolução de problemas com robôs
- Atividades ou fichas de trabalho prontas para usar com os alunos
- Acesso a uma biblioteca de aplicações robóticas pré-construídas
- Workshops de desenvolvimento profissional ou materiais de formação
- Apoio de uma comunidade de educadores que utilizam robôs educativos
- Ferramentas de avaliação para avaliar os resultados de aprendizagem dos alunos com robôs

- Outro_____

9. Na sua opinião, qual seria o benefício mais importante da utilização de robôs na sua sala de aula:

- Social (por exemplo, melhorar o envolvimento dos alunos e o trabalho em grupo; facilitar a aprendizagem interativa e prática…)
- Motivacional (por exemplo, aumentar a motivação dos alunos, promover o interesse pelas áreas STEM…)
- Cognitivo (por exemplo, proporcionar experiências de aprendizagem personalizadas; oferecer novas oportunidades de aprendizagem aos alunos (por exemplo, aprender programação e robótica)…)
- Inclusivo (por exemplo, ajudar os alunos com necessidades educativas especiais, apoiar os alunos com dificuldades de aprendizagem e outras dificuldades, atender às necessidades individuais dos alunos)
- Prático (por exemplo, reduzir a carga de trabalho do professor para tarefas repetitivas, melhorar a gestão e monitorização da sala de aula…)
- Nenhum/Outro_____

10. Numa escala de 1 a 5, de acordo com a sua opinião, qual seria a reação dos seus alunos ao terem robôs na sala de aula?

5- Muito positiva, 4- Um pouco positiva, 3- Nem positiva nem negativa, 2- Um pouco negativa, 1-Muito negativa

IA em AEE

O que é a inteligência artificial (IA) nas atividades de ensino e aprendizagem (AEE)?

A IA refere-se, em grande parte, a grandes modelos de linguagem (LLMs) concebidos e programados para executar tarefas cognitivas que normalmente associamos à tomada de decisões humanas e à capacidade analítica. A IA na educação tem diversas aplicações, todas com o objetivo de apoiar a aprendizagem dos alunos e melhorar a eficácia do educador. Recentemente, um tipo da IA – inteligência artificial generativa (IAG) tornou-se amplamente utilizado nas escolas por professores e alunos (por exemplo, ChatGPT, Microsoft Copilot, etc.). Foca-se especificamente na criação de conteúdo, seja sob a forma de texto, imagens, música ou outros media. Embora a IA tradicional envolva frequentemente a análise e a tomada de decisões com base em dados existentes (como reconhecer padrões ou fazer previsões), a IA generativa trata de aproveitar a criatividade e criar conteúdo.

1. Existe algum documento ou orientação nacional/escolar sobre como incluir a IA no ensino e na aprendizagem?

Sim / Não / não sei

2. Qual é a sua experiência com a IA no ensino?

- (0) Nenhuma– não tenho experiência nem conhecimento
- (1) Utilizador iniciante – Conheço o tema, mas não tenho experiência prática
- (2) Utilizador funcional – utilizei a IA no ensino
- (3) Utilizador avançado – utilizei a IA no ensino e posso ajudar outras pessoas a utilizá-la
- (4) Utilizador especialista – utilizei IA e posso ensinar ou treinar outras pessoas para utilizar IA

3. Escolha as ferramentas de IA que utiliza ou gostaria de utilizar no seu ensino:

- Ferramentas de texto e escrita (ChatGPT, Duolingo, Cognii, LanguageTool, Scholarcy…)
- Ferramentas de produção e edição de imagem (PhotoRoom, Picsart…)
- Ferramentas de áudio/texto para voz/música (Speechify, Wellsaid…)
- Ferramentas de planificação de aulas (To-Teach, Quizizz, Slidesgo, SchoolAI, Quizlet…)
- Ferramentas para comunicação e envolvimento professor-pais
- Outras ferramentas _____

4. Existem pessoas na sua escola que já utilizaram a IA no ensino?

Sim / Não / não sei

5. Os seus alunos usam IA na sua aprendizagem?

- Sim, de acordo com as minhas instruções para aprendizagem/tarefas/preparação para exames
- Sim, mas esta utilização não é significativa/recomendada por mim
- Não
- Não sei

6. Tem alguma formação (formal ou informal) sobre o uso da IA no ensino? (Se a resposta for sim, explique.)

Sim _____/ Não

7. Os seus alunos participaram/participam em alguma aula/tema de literacia em IA? (Se a resposta for sim, explique.)

Sim _____/ Não/ Não sei

8. Numa escala de 1 a 5, quão forte seria a sua intenção/motivação para utilizar/continuar a utilizar a IA no ensino?

5 Muito forte – 4 Um pouco forte – 3 Nem forte nem fraca – 2 Um pouco fraca – 1 muito fraca

9. Na sua experiência, quais são os obstáculos externos mais comuns à utilização da IA no ensino:

- Sem normativo/documento/orientação relevante para escolas/professores
- Falta de formação disponível para os professores
- Falta de apoio técnico
- Falta de apoio financeiro
- Falta de apoio dos pais
- Falta de motivação dos alunos
- Falta de motivação (própria) do professor
- Baixa consciência dos possíveis usos da IA
- Questões de segurança e privacidade
- Outro_____

10. Quão forte é o seu interesse/motivação para aprender a utilizar a IA no ensino?

5- Muito forte, 4- Um pouco forte, 3- Nem forte nem fraco, 2- Um pouco fraco, 1-muito fraco

11.Na sua opinião, qual seria o benefício mais importante da utilização da IA na sua sala de aula:

- Social (por exemplo, melhorar o envolvimento dos alunos, o trabalho em grupo e a colaboração online)
- Motivacional (por exemplo, aumentar a motivação dos alunos, promover o interesse pelas áreas STEM, escrever...)
- Cognitivo (por exemplo, proporcionar experiências de aprendizagem personalizadas, oferecer novas oportunidades de aprendizagem)
- Inclusivo (por exemplo, ajudar os alunos com necessidades educativas especiais, apoiar os alunos com dificuldades de aprendizagem e outras dificuldades, atender às necessidades individuais dos alunos)
- Prático (por exemplo, reduzir a carga de trabalho do professor para tarefas repetitivas,melhorar a gestão e monitorização da sala de aula…)
- Nenhum/Outro_____

12.Numa escala de 1 a 5, de acordo com a sua opinião, qual seria a resposta dos seus alunos à utilização da IA no ensino e na aprendizagem, em sala de aula?

5- Muito positiva, 4- Um pouco positiva, 3-Nem positiva nem negativa, 2- Um pouco negativa, 1-Muito negativa

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