**Emotional Empathic Proximal Learning Educational Environment
PEARL
2018-1-IT02-KA201-048515**

O6- White paper on the value of educational emotions and educational robotics in the 0-6 age group, scientifically testing and validating inclusive communication and peer learning dynamics that develop in a proximal learning environment

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DESCRIPTION OF THE PROJECT AND OBJECTIVES

The Erasmus+ KA201 project PEARL "Emotional Empathic Proximal Learning-Educational Environment" is a European project supported by the European Commission within Erasmus+ KA201 2018-1-IT02-KA201-048515 by the Italian National Agency from 1st September 2018 to 31st August 2021. It aims to develop and validate a unique, innovative, high-quality educational model for children aged 1-6 years that can be replicated at the European Level. All materials and complete research results are available on the project's website https://pearl-project.org

The project PEARL has been highly experimental, with the goal of developing and validating a new inclusive educational model based on concrete and solid neuro-psycho-pedagogical theoretical foundations, combining academic research (Vygotsky, Piaget, Montessori, metacognitive pedagogy, proximal learning, co-structural, environmental, and relational constructivism) with modern educational strategies such as peer education, cooperative learning, constructivism, and the utilization of information and robotic technologies from Clementoni (one of this project's partners) (in particular for the 3-4 and 5-6 years age group). The notion of utilizing simpler robots has been excluded for the age group of 0 to 2 years, and other strategies (nature and blocks) have been chosen instead.

The idea of PEARL project came from listening to the needs of pre-school teachers and understanding that it is necessary to start using an educational approach at an early age based on empathy and awareness of the educational emotions that can be stimulated through contact with others and training the teachers in how to develop an empathetic proximal learning environment.

One of the benefits of the project comes from the introduction of educational robotics used in groups as a tool to facilitate relations between children and promote inclusion thanks to the characteristics of the robots used. That is, robotics is used as a tool for inclusion and open communication strategies, as well as for the development of relational, emotional and prosocial skills in small group activities.

Therefore, for this age group, the creation of the empathic and emotional proximal educational environment will take place mainly through activities related to nature and respect for the environment, such as developing the internalization of the sense of eco-systemic belonging with the world.

For the creation of a proximal learning space that favours a correct approach to robotic technologies as educational and learning instruments, the PEARL model places group, peer relations, and the development of empathetic emotions at the centre of its action.

In the relationship with peers, the child can take on diverse roles and is called to cooperate in the small group and to agree by learning to take the perspective of others (Piaget 1932), developing cooperation and sharing skills. The group relationship not only leads to empathic emotional development but also to a cognitive one: the solution of problems, reached in a shared way, is internalized as the content of thought ("genetic law of cultural development" Vygotsky 1987). The project's methodology pays special attention to the inclusion of all children beyond their talents, their potential, personal difficulties, or disabilities.

The project reveals a lot of potential in changing the educational approach, leading teachers to pay attention to the creation of a proximal learning environment in which children can develop their social and emotional skills within the group.

OBJECTIVES

– To establish an international network of experts and organizations in close collaboration with the academic world, teacher training institutions and educational institutions for the promotion of innovative and quality education in early childhood

– To create new curricula for teachers for the development of the skills necessary to adopt and implement the experimental educational model in early childhood.

– To establish a new approach to early childhood education through the creation of the "white paper" book on educational approaches and models tested in children aged 0-6 years, aimed at national and European public bodies and decision-makers.

DESCRIPTION OF THE PARTNERSHIP

Project partners represent educational institutions at different levels:

Polo Europeo della Conoscenza (Italy) is a public body, non-profit – network of educational Institutions among them: schools of every order and degree at the national level, universities, adult education organizations, Regional Administrations, VET schools, NGOs, and cooperatives that works for the European social and educational integration. Its main field of activities are to promote the European dimension and integration through workshops, seminars, conferences, partnerships and projects. Europole network is constantly coordinating "umbrella activities" involving the greatest possible number of institutions of the consortium.

Europole is the promoter and the coordinator of PEARL project, thanks to its experience in this field. In the recent past, Europole has already worked on projects concerning pre-school education. The 4000 institutions and members of the network, are working with learners at risk of social and cultural exclusion: immigrants, refugees, drop-outs and learners with disabilities and other special needs, with social-psychological borderline situations. One of the main fields of activity of the network in the last years has been educational robotics focused on prosocial values and human rights.

Within the Europole network of schools there are experts in both early education and robotics who have been involved in the development of the whole project from the conception phase to the adaptation to the changed experimental situations.

Stefano Cobello is the coordinator of Europole. He has extensive experience in coordinating networks of institutions in European projects He is an expert in intercultural education and in sociology. Stefano Cobello has a PhD in sociology, in the inclusive models of education for disabled people and a MA in philology - Russian and English. Stefano Cobello is a Lecturer of the Italian language and History of art in the East Oriental Siberian Russian Academy – Ulan – Ude (Buriatia) and Permanent Teacher since 1994 for the VET Catering and Hotellery School Luigi Carnacina – Verona.

He has been responsible for a European social information office and for a Small and Medium Enterprises foundation. He has been in charge of training teachers in the Regional administration and responsible for youth in Action European programme in Veneto Region.

Elena Milli is a family and relational psychotherapist. She works with children and teenagers with special educational needs or social and behavioural issues, from abusive or disadvantaged contexts and immigrants. She has coordinated a home assistance educational service for students at risk. She structured psychological, educational and social interventions based on the individual needs of the students, working with teachers and parents, in cooperation with the social assistance service. She worked as a school assistant for children with special educational needs.

She is an expert and trainer in educational robotics. She is also a trainer for communication and psychological subjects. She collaborates with Europole in Horizon 2020 and Erasmus+ projects about robotics and special needs education, bullying, STEM education, environmental awareness, giftedness, immigrants and refugee students.

Giulio De Vivo is a teacher and pedagogue expert in assessment and evaluation. He is working for the Regional Department for Education of the Marche region – General direction for national projects. He is a teacher trainer, active member of the

Movimento Cooperazione Educativa (Movement of Cooperative Education) and founder of the website www.senzavoto.it that provides information, good practices and material on innovative teaching and evaluation strategies.

Department of childhood Education of the Gazi University of Ankara (Turkey). Gazi University is one of the few universities whose history dates back to 1920s. The Faculty of Education at Gazi was established in 1926. The basic objectives of the Faculty are as follows: To educate students in order to be professionals in educational terms and to gain foresight, as well as assisting them to respect the ethical values and social aspects of the public. The self-consciousness of educational issues is also highlighted to ensure development of self-responsibility along with the personal skills of students. Students are expected to benefit from academic innovations and in turn contribute to the improvement of the scientific advances of their community. The scholars have also been educated in order to be open-minded for the development of science, perceiving events in such a conceptual perspective that reflects the way of true life and always be respectful to the common benefit of the public. Students have also been educated in a way to become open to the opinions of others in a cooperative society.

Gazi University carries out its education in three different campuses called Besevler, Emek and Maltepe in Ankara. With its 50 thousand students and more than 4000 academic staff the university is close to the world average in terms of the number of students per instructor.

The experience of scientists, who participate in this project, is increased by participating in the process of developing an innovative education model in pre-school education. This is undoubtedly an important transfer of experiences and knowledge. In this process, project participants witness different practices carried out in different countries. This promotes the increase of experience and observations related to new approaches and teaching techniques.

Esra Ömeroğlu, Full Professor- Prof. Ömeroğlu achieved her doctorate in Child Development and Education from Hacettepe University in 1990. While she was working on her PhD dissertation, she received a PostDoc fellowship from London University in 1988 and studied drama in early childhood education. In addition, she received a visiting scholar position at Purdue University, Indiana in the USA in 1990. Prof. Ömeroğlu has over 200 national and international publications and conference presentations. Her area of research interest includes drama in early childhood education, parent education, curriculum development, social skills and problem solving skills in young children, and development of creativity in young children. She took part in the preschool curriculum development of the Turkish Republic Ministry of Education in years 2002, 2006, and 2013. She has extensive experience in both national and international projects as a coordinator and as a partner. She took part in projects funded by the European Union (e.g. Strategies for Talented and Gifted Pupils' Teachers, 2015-2018; The Respective of the Cultural Difference in Early Childhood Period, 2006; Comenius Reggio Project, 2013-1025), projects funded by the Scientific and Technological Research Council of Turkey (e.g. Social Skills Support Project, 2010-2013; Problem Solving Skills Scale Development for K-5 Project), projects funded by the Turkish Republic Ministry of Education (e.g. the Peace Culture Project, 2003), and projects funded by Gazi University (e.g. Immigrant Parents' Social Adaptations and Skills).

Ümit Deniz, Full Professor- Prof. Deniz earned her doctorate in Child Development from Ankara University in 2003. Her area of research interest includes mother-child health,

social development, sexual development and education of young children. She took part in projects

funded by The Scientific and Technological Research Council of Turkey (e.g. the Science School for the Future Scientists Project, 2014), projects funded by UNICEF and the Turkish Republic Ministry of Education (e.g. Empowering the Preschool Education in Turkey Project, 2012), and projects funded by Gazi University (e.g. Sexual Knowledge, Attitude and Behaviours of the Teacher Candidates, 2012). She took part in the preschool curriculum development of the Turkish Republic Ministry of Education in 2013.

Saide Özbey, Full Professor- Prof. Özbey earned her doctorate degree in Preschool Education from Gazi University in 2009. In addition to her position as a faculty member at the Preschool Education Program, she is also the director of the Gazi University Application Kindergarten. Her area of research interest includes curriculum development, social skills and problem behaviors, science education, motivation in young children, and psychological reslience . She took part in projects funded by Gazi University (e.g. Social Skills and Problem Behaviour Education Program for Young Children, 2009), projects funded by the European Union (e.g. Little Geniuses Using Computers: Butterfly Effect, 2011).

Aysel Tüfekci, Assistant Professor- Prof. Tüfekci earned her doctorate degree in Curriculum and Instruction from the University of Illinois at Urbana-Champaign, USA, in 2008. Her area of research interest includes social and cultural foundations of education, parent-child relations, school success, and qualitative research methodologies. She took part in projects funded by Gazi University (e.g. An Adaptation Study of The Parenting Scale into Turkish and Investigation of the Association of Maternal Disciplinary Practices with Child's Behaviors, 2011-2014; Teacher Candidates' Sexual Knowledge, Attitudes and Behaviors, 2011-2013) and projects funded by the Kars Kafkars University (e.g. The Impact of Fluent Reading Practices on Turkish Teacher Candidates' views towards Reading, 2017-continues).

Nafia Kübra Karakaya, Research Assistant- Karakaya is currently a doctorate student at Gazi University. She earned a bachelorette and master's degree at Middle East Technical University. Her Master's thesis is about Social media and early childhood education. She is currently interested in digital technology and early childhood education and refugee children.

Consejería de Educación. Junta de Castilla y León (Spain) is the Department of Education of the Autonomous Government of Castile and León (JCYL). The Directorate-General for Vocational Training, Special Regime and Educational Equity is one of the main administrative units of the Department of Education and it's the one involved with the project. Among the General Directorate's tasks, attributions and competences are: Planning the academic organization, curricular design, and the elaboration of pedagogical guide-lines and the elaboration of curricular materials for the development of the teaching function, the organization of the needs of school units and training positions in centres held with public funds and the planification and management of teachers on service training on the topics of its competences. It is also responsible for planning and management of resources for the attention for pupils with specific educational needs and the educational and psychopedagogical guidance.

The branch for the Educational Equity has specific attributions through the CREECYL for the development of activities and materials, curricular and extracurricular for promoting education within an inclusive framework, collaborating on training activities for the educative community linked with educational equity and equal opportunities

issues. It is also involved with research and innovation in regards to educational equity, early detection of specific and special educational needs.

Experts in early education, educational inclusion and robotics were brought in for this project, and they were actively involved throughout the whole development process.

Maria Antonia Blanco González: Psychopedagogy degree and Special Education Teacher degree. PhD candidate on Pedagogy. Extensive experience with management positions both at schools and on the educational branch of the regional government as head of the section for pupils with specific needs and educational support where she promoted and is developing inclusive projects in the educative sector. She is an expert in Special Education and Pedagogy with 19 years of working experience with pupils with disabilities, learning difficulties, immigrants, gifted children and pupils under social exclusion risk. She achieved research proficiency in the Pedagogy Department at University of Valladolid in 2006. She is a member of the national working group for "Children and gender violence study" promoted by the Ministry of Education and Vocational Training of Spain.

Sonsoles Perpiñan Guerras: Psychologist, specialist in Early Childhood Education and Early Care. Director of the Avila Early Attention Team of the Education Department of the Castile and León Regional Government. Coordinator of the National Network for Early Down Attention in Spain. President of the Castilian Leonesa Association for Early Attention. Lecturer in Early Childhood Education and Early Attention at various universities in Spain and Latin America. Trainer at teacher training centres, disability associations and in public administrations. Author of three books: "Emotional health in childhood", "Early care and family", "I have a student with Down syndrome." Co-author of various publications of the State Federation of Associations of Early Care Professionals and Down Spain.

Beatriz Herrero García: Social worker degree with more than 15 years experience as a Technical teacher of Community Services, highly experienced in working with families and children under social exclusion situations. Trainer of trainers in the topics of childhood in risk and supportive strategies for families. Currently working at CREECYL and member of the organizing committee of the Castile and León extracurricular program for gifted children.

Mª Rosario Arribas Sanz: Teacher degree, support teacher specialist on hearing and language with extensive experience in early childhood education and innovative approaches on experimental experiences of new models of inclusive schooling for children with special education needs. Member of the Educational and multiprofessional guidance team for equity in Castile and León.

Ana Mª Cabero Abad: Master in neuropsychology of education. Degrees in Psychopedagogy and Special Education. Headmaster of CREECYL (Educational and multiprofessional guidance team for education in Castile and León). Educational Psychology counsellor of the Castile and León government, as a civil servant, with experience in several specific services in Early childhood Education, Primary and Secondary and high schools. Expertise in organizing workshops, seminars and developing and piloting innovation projects in formal and informal educational environments.   Member of the organizing committee of the Castile and León extracurricular program for gifted students that includes coding, biomedical research, advanced archaeological techniques including ICT approaches; she is also in charge of ensuring that socio-economic vulnerable groups and gender equity are included and actively participating in the workshops organized.

Panevezys Distric Education Centre (Lithuania) is a public and non-profit organization established by the Council of Panevezys District Municipality in 1995 and located in Panevezys City, Lithuania. The purpose of the Centre is to develop professional competence of the members of school communities and promote the dissemination of perspective pedagogical innovations. The centre provides an in-

service training for 21 educational communities situated mainly in the Panevezys District. The education Centre is a member of the association of education centres in Lithuania (50 organizations). The Centre strives to develop professional competence of different community groups (youth, members of school communities, seniors) and promote dissemination of innovations in education.

The team of the Centre offers research activities and learning projects, developing cooperation among different community groups, governmental organizations, non-governmental organizations and foreign partners. It responds to the needs of the educational community, regarding qualification, professional and cultural aspects.

It organizes open activities in schools, focusing on children with special learning needs and moderate discussions in the following processes and cooperates with regional pedagogical and psychological service office and designs new methodology brochures and recommendations for teachers.

The Education Centre rallied a team of experts, able to effectively carry on the project activities.

Jurgita Vaitiekūnienė is the director of Education Centre. She has higher teacher training education and is a primary school IT and economics teacher. Before she used to be a school principal. In 2014 she graduated from ISM Management and Economics University, Leadership in Education Management program and was awarded a Master's degree in management. She has a lot of international experience, participated in professional development courses as well as in Comenius, Grundtvig, Erasmus+ projects. She was an auditor of the National School Assessment Agency. While participating in the national project she was responsible for "Peer coaching" and "Lesson Development to Shape Competences of the 21st Century". She willingly shares her experiences internationally. She is a board adviser (EAB) in Horizon, 2020 project "Protein".

Dr. Inga Zilinskiene. Since 2012 she has worked as an assoc. prof. at Mykolas Romeris University. Recently she has given lectures on Statistical Analysis in Psychology and her research interest is focused on contemporary issues in e-learning, its personalization and evaluation. Previously she worked at Vilnius University as a researcher in the Department of Informatics Methodology. She is a member of the Scientific Committee of the International Scientific Conferences "Innovations and Creativity", 2019, 2020, https://icic.liepu.lv/icic.liepu.lv/par/scientific-committee/. She worked in multiple national and international projects, e.g. as project manager of "Development of ICT tools and their application strategies in an educational environment", 2012-2014, Education Development Centre; as an expert in Erasmus+ project "Prosocial values", 2017-2019.

Daina Murauskiene is the principal of Dembava kindergarten "Smalsutis" and is responsible for strategic institution management, development process organization and supervising and implementation of educational policy. She is also a mentor of the principals of educational institutions. Her interests are innovative means and methods as well as their adjustment in development process; she also encourages and motivates staff members to seek improvement and innovations at work. She is an expert of Erasmus+ KA3 project "Early childhood education-building sustainable motivation and value paradigm for life".

Clementoni Spa (Italy) a corporation producing educational games that has enriched the project with its pragmatic view.

Clementoni is a 55 year old company, leader in Europe, in educational toys and games. With 500 employees in Italy and more than 80 abroad, the Group currently has sales offices in Spain, Germany, France, Portugal, Poland, UK, Turkey, Benelux and an operating subsidiary in Hong Kong. The company supplies products in more than 70 countries around the world, producing 30 million products every year, of which 80% is "Made in Italy". With its long and wide experience in projecting (from the idea to the development and production) educational items, Clementoni knows very well what children like, and how they can enjoy and be surprised by a toy or a game. The company has a good know-how in: a) Teaching through games and toys. b) Creating INTERACTIVE products so that children are not playing in a passive way, but can learn thanks to their action and reaction with the toy c) Introducing a way to let the parents check the progress of their children in knowledge, learning and physical abilities. Clementoni has a department of Research and Development with over 50 young people (average age: 32 years old) working on: a) New ideas for products b) Design of toys c) Graphics and illustrations d) Industrial project of the items e) Development of the products f) Apps creation and production with its SAFETY REQUIREMENTS OFFICE, (Clementoni test every new product for compliance with the toy safe standard) the Company has experience and updated knowledge about how a toy needs to be completely safe for children. In its ADVANCED RESEARCH area, innovations and new technologies are studied and examined, in order to be applied in new products for children.

Since 2014 Clementoni has studied and created robots to help children of different ages to use coding and educational robotics in an easy and fun way at home or at school with a great value for the money.

Clementoni, thanks to the Advanced Research Area, knows very well the educational needs of teachers and pupils of infant and primary schools. This information is shared with the R&D Dept. which develops the project involving the use of robots as an educational tool to promote alternative approaches to STEAM subjects. There is also a specific attention about design educational tasks focused on gender and social inclusion.

Pierpaolo Clementoni has a degree in Economics and Marketing, he has experience in different areas, mainly in Research and Development, Marketing and Advanced Research. He is involved in research innovations and new technologies about the toy market but also in the educational context of schools. He cooperates with different universities to study and explore new scientific teaching methods to be applied in games and toys, to let children learn by playing and enjoying. In 2017 he began the project "Cooding School with Sapientino", promoted by Clementoni with the Italian Ministry of University and Research and the Department of Computer, Control and Management Engineering at Sapienza University of Rome.

Tamara Lapucci has a degree in Science of Communication and a PhD in Educational Science with a specialization in Psychology of Education. She worked at University of Macerate where she taught Methodology of Child Observation and Communication Strategies in Educational Context in the Faculty of Science of Education. During the

PhD her field of research was: life-long learning, distance teaching-learning strategies; assessment training,; cooperation, negotiation and knowledge co-construction. She is currently Area Test Manger in Clementoni, where she coordinates and organizes activities of research about the toys all over Italy (with children and parents) with the aim of collecting data to improve the educational impact and the structural quality of toys produced. To reach this purpose she works with an internal team of game experts and psychologists, and she collaborates with educationalists and teachers in different educational institutions. She also organizes training courses for infant and primary school teachers where she teaches alternative didactic methodologies based and aimed to educate children about STEAM disciplines using innovative, inclusive and playful tools as Clementoni robots.

Matteo Paolucci has a degree in Translation and Community Interpreting. Since 2008 he has worked at Clementoni Research and Development Department. Presently he is a Senior Product Manager of Digital and educational toys where he coordinates a team of young inventors with different competences and specialization areas and follows the main projects of development of educational robots and coding toys.

WHAT IS PEARL MODEL?

Theoretical foundations

The theories at the base of PEARL are Piaget's Theory of Cognitive Development, Vygotsky's Sociocultural Theory, Montessori Method and Bandura's theory of social learning. Piaget and Vygotsky configure the knowledge from the constructivist approach.

PEARL model has been, therefore, developed based on the most recognized psychopedagogical theories, transforming and adapting them. Going beyond because, "the properties of the systems cannot be described by explaining only each one of their separate elements" (Bertalanffy, 1969). The interactions between the various theories produce synergies and symbiosis resulting in a whole that is greater than the sum of its parts.

During the conceptualization and developmental phase of PEARL, the interaction of the theories at the base revealed a metabolization process in which new concepts have emerged from the interlocking of the various theories formed. PEARL model favours student motivation, attention to diversity, collaborative learning, and emotional education. It is centred on creating motivating educational environments where early childhood children can collaborate with each other and take advantage of the potential of their emotions to develop their diverse abilities. The integration of the different psychopedagogical theories seek to promote a balanced comprehensive model, capable of combining the human, intellectual, ethical, social and emotional dimensions.

Based on the contributions of different psychopedagogical theories, the model is defined around six lines that support it: educational environment, emotion (educational emotions), empathy and zone of proximal development, educational robotics and roles.

Theories of **Piaget** and **Vygotsky** form the constructivist basis of the PEARL model. The theory of cognitive development explains how a child constructs a mental model of the world. Piaget suggested that all children journey through the sensorimotor, preoperational, concrete operations, and formal operations stages of development (McLeod, 2018). Sensorimotor and preoperational stages are those related with early childhood education stages. During the sensorimotor stage from birth to age 2 infants absorb information through their senses: by touching, looking, and listening. An infant may first not make sense of a specific toy, but as they begin to look at it, feel it, and manipulate it often, they are able to represent the object in their minds (Kurt, 2020). Starting at the age of 1, children are beginning to develop sensory-motor skills before their language develops (Piaget, 1965). But in presence of a new object, even without knowing how to talk, the child knows how to assimilate, to incorporate this new object into each of his already developed schemata (Bruce, A., Marlowe, A., Canestrari, 2006). During preoperational stages from 2 to 7 years old children learn though play and imitation; have egocentric thinking which means at this age children do not easily understand other people's point of view and they begin to develop the ability to place themselves in the place of others by acting and playing roles. By playing children explore their limits, reinforce social and prosocial skills; it enhances in children the ability of controlling themselves and their reactions, for finally overcoming their egocentrism.

The Russian psychologist Lev **Vygotsky** theorized that interaction with others has a great influence on cognitive development (Hockenbury et al., 2011). He argued that children have the capacity to accomplish larger amounts of cognitive improvement

through social interaction, Piaget failed to acknowledge this influence (King, 2011). Piaget established his cognitive development theory based on children's dealing with physical objects, however, Vygotsky believed that a child's mind develops when they interact with other people's minds (Bernstein et al., 2008). During this interaction, children use language to ask questions, and others respond to them, this process contributes to the development in the cognitive ability of children (Cacioppo &Freberg, 2013) and (Babakr, Mohamedamin & Kakamad, 2019).

Constructivist approach explains what knowledge is and how it is learned (Erdem & Demirel, 2002). It supports a child's structuring of the knowledge with his/her own mechanisms in the process, in which s/he is involved by experiencing, rather than memorizing ready-made information (Perkins,1999). Active participation children in their own learning processes and constructing knowledge by experience make learning permanent (Cole and Wertsch, 1996). Concrete experiences and well-designed materials make it easy for children to construct knowledge. Vygotsky created the concept of the zone of proximal development, often abbreviated as ZPD, which came to be a central part of his theory. Language is the way that a child communicates with others after they are born and they continue to learn by interacting with those around them. Building on his idea of social interaction as the basis for learning, he broached the value of a mentor or teacher in the life of a student (Kurt, 2020). The zone of proximal development consists of two important components: the student's potential development and the role of interaction with others. Therefore, learning activities are designed around social interaction between students and tasks working in groups collaboratively. Moreover, the teacher, who acquires the scaffolding method well, guides and aims to support children's developmental potential. In the PEARL Education Model, it is essential to allow all children, regardless of their skills, to reach their developmental potential by including them in the education process.

The learning process occurs through the interaction of the mind and the environment. In this process, an individual tries to explain a new situation by his/her previous schemes created in the past. If a newly encountered situation is explained with existing schemas, this refers to reinforcement of previous learning rather than a new learning process. If a newly encountered situation cannot be explained with existing schemas, a new schema is needed and the learning process begins. In the learning process, an individual undertakes assimilation, adaptation, and balancing (Bacanlı, 2011). When a new information reaches out balancing phase, learning takes place. Thus, an individual constructs knowledge with the influence of the environment and his/her own mental processes (Beilin,1994). In the PEARL Education Model, the children have been allowed to construct the information they obtained as a result of their interaction with the environment (such as teachers, organizing the classroom environment, integrating materials such as robots into activities) (Beilin,1994; Cole and Wertsch, 1996; Erdem and Demirel, 2002; Vygotsky,1978).

Vygotsky argues that an individual constructs information by interacting with people in his/her social circle. There is information that an individual can configure on his/her own. In the zone of proximal development, there is information that an individual can construct with a peer or an adult (Vygotsky, 1978). An individual can construct any information that s/he cannot by scaffolding method. The PEARL Education Model attaches a special importance to the zone of proximal development, and argues that peer communication and effective teacher support are required for children to realize their potential. For this reason, teachers have supported the zone of proximal development of children properly by observing their level of development and have urged to share their ideas, cooperate and perform task distribution behaviours in the PEARL Education Model. Moreover, they have also provided environments in which children can overcome the difficulties that they face during the activity with their peers in accordance with their level of development by granting children with the

opportunity to try out solutions and perform trial and error processes. What is more, teachers have created environments where children can show empathic emotions and have given feedback by appreciating their social, collaborative, sharing and empathic behaviours in the group.

The **Montessori**'s approach adopts a philosophy urging that every child should be provided with his/her own sovereignty and freedom. It is a child-centred approach allowing children to learn at their own pace. In the Montessori approach, it is emphasized that five sense should be at work actively in learning (Koh and Frick, 2010). The Montessori Method is based on spontaneity and child freedom promoting learning by discovering, through direct contact and practice. It is characterized by providing a prepared environment: tidy, pleasing in appearance, simple and real, where each element exists for a reason in order to help in the development of the child (The Absorbent Mind: A Classic in Education and Child Development for Educators and Parents: Montessori, Maria, Chattin-McNichols Ph.D., John: 9780805041569: Amazon.com: Books, no date). Teacher role is to be a guide allowing the child to act, wish and think for him or herself, helping him or her to develop confidence and inner discipline, emphasizing the importance of children's learning by experience.

Albert **Bandura**, on his social learning theory develops the idea that human behaviour occurs in the interaction between the person and his or her environment. He proposes that learning is a cognitive process that takes place in a social context and primarily occurs through observation, reinforcement, or direct instruction. Even if observation and model are important, they are not enough for learning to take place; the model must be attractive and of interest to the person being modelled. This is due to the ability to see ourselves in the behaviours of others.

Bandura shows that the environment in which children develop will enhance or weaken the development of children skills and will also depend on whether we can mobilize in different environments or social contexts by allowing more diversity of learning and developing different skills. Depending on the environment that we select.

The essence of observational learning is imitation; it involves cognitive processes and does not consist of simple mimetics or repetition. It is more than repetition or matching the actions of other people, it involves the symbolic representation of information and storing it for future scenarios.

This approach of the PEARL model starts from the present and goes to the future. It reveals many opportunities to improve educational methods, leading teachers to focus on creating a proximal learning environment in which children can develop their social and emotional skills within the group.
PEARL is an innovative and inclusive educational model that aims to create motivating educational environments where Early Childhood Education children can collaborate with each other and take advantage of the potential of their emotions to develop their diverse capacities.
For this, the tutor will offer the children a small group environment, with motivating materials that they can manipulate, including the integration of educational robotics, because it has been proven that handling the robot arouses a lot of emotion among children, and will help them to define roles within the group that will facilitate social interaction and the achievement of a common goal.
The model is based on solid theoretical foundations and is defined around 6 pillars that support it: educational environment, emotion, empathy, proximal learning environment, educational robotics and the assignment of roles to members within cooperative learning groups.

PEARL model pillars

Educational environment

In educational settings, the environment refers to a specific space, located in classrooms or its immediate environs (corridors, etc.) where pupils work simultaneously on an area, activity or project.

These spaces are designed to function in each student's zone of proximal development by providing materials, activities, and challenges that pique their interest and motivation.

It is a scenario of diversity of people, content and type of activities, focused on exploration, experimentation, action and expression.

Educational environments promote autonomy, creativity and imagination. They allow the possibility of developing a flexible methodology promoting activities based on the universal design for learning, available for different levels of learning. It gets active participation of all the classroom members by following a participation protocol based on the role assignment.

Educational environments encourage oral communication and allows teachers to observe the relationships established between children.

The educator creates a physical and emotional environment where children can express themselves, interact and build learning from the relationship with their peers.

When we speak of the environment, we consider the set of elements that constitute the learning episode, not only the materials or the proposed activity, but the relationship dynamics established between the students.

The teacher allows children to manipulate materials and express themselves freely and also encourages doing it in a group, strengthening relationships and emotions that surround this process, making it richer and more motivating.

This model highlights the need to intervene in natural environments and to create spaces where learning occurs through interaction. The transactional model (Sameroff Fiese, 2000) and the General Systems Theory affect the importance of the child's interactions in their natural environments.

Emotions

The educational environment propitiates the emersion and expression of emotions. There is no learning without emotion. Authors such as Miller (2002) and Pintrich (2003) consider that learning does not only refer to the "cold cognition" of reasoning and problem solving;

learning and information processing are also influenced by emotions, it means that "warm cognition" is also important in learning.

Mora Teruel (2018) states that if the events are emotionally significant, attention, memorization and other cognitive processes will improve. Therefore, it is necessary to create environments where children's emotions allow to create associations and build learning.

The relationships between children in the PEARL model elicit a multitude of educational emotions, making the learning process much more motivating and meaningful.

Happiness has been observed to make cognitive organization more flexible, producing more neural associations (Bisquerra, 2000: 64), and neuropsychological research (Ibarrola, 2013) indicates that emotions affect perception, attention and memory, which is what decides what information is stored in the neural circuits and therefore is learned.

Our brain has an emotional filter named "amygdala," which filters incoming information and stimuli. The amygdala intervenes in implicit learning processes; it accepts information and stimuli only if it is "stress-free." This implies that the more positive emotions we present to our pupils, the more we will promote their development.

If a child's emotional centre identifies stress, it will prompt the brain to fight, flee, and "freeze." This means that when the learning environment is stressful, children tend to cry or throw a tantrum (fight), they want to run away from the activity, they begin to behave aggressively as a class and they "freeze" in their responses.

Ainswroth (1978) and Bowlby (1993) already highlighted the importance of the affective bond as a motor of development. Their contributions have been strengthened by new theories about neuroscience.

Empathy

Empathy is the ability to experience the emotional states of other people, to perceive, interpret and understand what happens to the other and share their feelings.

On the early childhood children are characterized by an egocentric thinking (Piaget, 1969) that they will overcome through play, vicarious observation and imitation of adults and peers (Bandura, 1986).

The learning environment that is proposed as part of the PEARL model focuses on creating empathy between children who do activities together, so that they can share their emotions and accept diversity. It thus constitutes an educational style that favours attention to diversity.

The distribution of roles in collaborative tasks allows children to adopt different points of view, consider their own abilities and difficulties and those of their peers and come to build a final product or achieve an objective or run a task with the contributions of all.

This framework of educational action allows and enhances the possibility of giving a very adequate response to diversity, placing students with specific educational support needs in a role in which they can participate from their zone of proximal development and also favours mediation among students.

From the cooperative learning approaches (Johnson and Johnson, 1999) it is possible to overcome competitiveness and replace it with teamwork in which the child learns through relationships with peers and the role of the teacher is that of facilitator of a space for collaboration.

The research carried out in this project has allowed us to verify that despite the young age of the children, it is possible to work in the classroom from the construction of a learning environment that includes emotions, collaboration, role distribution and mediation. This represents an important advance in education from an inclusive framework, of educational quality and equity. Surpassing one-size-fits-all educational models.

Robotics in the early childhood education stage, from 3 years onwards, is constituted as a good facilitating tool for the creation of emotional, proximal and empathic learning environments

Robots allows children to experiment with materials, provokes the appearance of emotions in them and very rich interaction situations that increase the motivation, empathy and well-being of the child.

The study and the observation carried out has allowed an awareness of the natural interactions between children that often remain hidden because the action (role) of the teacher tends to be directive.
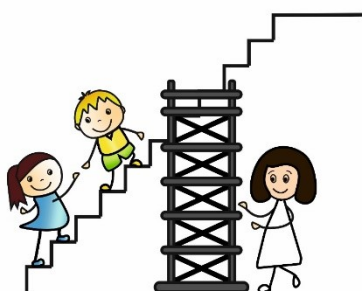
Proximal Learning Environment

This concept has its roots on the Vygotsky sociocultural theory but goes beyond it moving into a model of inclusion through relationships.

In his sociocultural theory, Vygotsky argues that social interaction has a significant influence on cognitive development. There is an internalization of cultural instruments such as language, which favour cognitive development. The activities that are carried out in a shared way allow children to internalize the structures of thought and behaviour of the society that surrounds them, appropriating them. In this way, all progress in development occurs first in an environment of social interaction, and then it gets internalised and becomes individual thought.

This theory considers the role of adults and more advanced classmates as companions in the learning process, thus giving rise to the concept of "scaffolding", which is the support provided to pupils to carry out a task until they are able to do it without help. This concept gives rise to another key concept in Vygotsky's theory called the zone of proximal development, understood as the distance between the real level of

development and the level of potential development determined through the resolution of a problem in collaboration with other peers.

Within this theory, it is highlighted the importance of student involvement starting from potentially significant content or the zone of proximal development of each student, from which to scaffold the construction of knowledge. The idea of knowledge construction is evolving from the Piagetian conception of a fundamentally individual process to a consideration of social construction where interaction with others through language is important

Group dynamics is a complex matrix that can be influenced by individual temper, presence of a friend in the group, size of the group, teacher's presence, personal reaction to frustration, among others. Within the group we could observe inclusion-exclusion, activity-passivity, leading-self isolation, and support to others- boycott the activity, will to participate, look for attention.

The proximal learning environment is a space where the children can share intuitions, actions, knowledge in a peer education space, facilitated by the group activities. It has taken origin by Stefano Cobello's Ph.D thesis relational perspective in the model of inclusion for disable children in Education (2021) as one of the main project pillars agreed with all the project partners. The "environment" is created by different factors, integrated one into the other: teachers role – facilitator and not provider of information, activity space – informal and cosy, suitable for children, children's attitude to cooperation and sharing (emotional space), attractive activities – the use or robotics for instance, and communication strategies – mainly organized within the roles attribute to every member of the group to fulfil the activities. The proximal learning environment has been widely experimented in this project.

Educational Robotics

Educational Robotics is one of the innovative elements of the project. Learning is more effective when it is not only mental, but supported by a real construction, by an activity such as the construction of a significant project. Educational Robotics refers to the theories and studies of Papert based on the advantages of using simple robots with educational purposes. We have chosen to use simple robots played with hands (not through tablets or other devices). We have explored how the use of robotics supports and creates a positive environment. Educational robotics creates a combination of fun and education to make the students attracted and interested to learn (Eguchi, 2014).

The robot is perceived as a toy, children feel like playing, they can experiment with his or her own experience that can also include failure as part of the learning experiences without the child feeling frustrated by mistakes so they can start and restart, repeat instructions to the robot once and again. With a robot children are allowed to make mistakes without being judged because the actor is the robot.

With the robot children can develop creativity; once immersed in the group activity children create their own world of imagination and as they start to play together they share their cognitive processes and learning strategies. Robots increase children's motivation and involvement, it increases their attention and helps to learn abstract concepts starting from concrete representations. Robots focus on story-telling

structure to encourage assembly of ideas, formal communication, cooperation and creativity. Students, in groups, are challenged to come up with solutions.

Experts suggest that education should focus on improved inter & intra personal communication for problem-solving and social interaction. This will facilitate increased innovation and creativity, depending on group-sharing, discussing, reviewing and refining ideas, to fit students for more interactive, discursive roles.

That is the reason for which we designed challenging activities to be solved working in a group, offering pupils the use of the robot and leaving children the space to work together and learn how to be in group. The activities are designed thinking also about children with disabilities and special education needs, starting from the statement that they have the same right of actively participating with the use of technology. The little robot we used during the research strengthen the possibilities of children with special needs because they feel able, and gives them the freedom of playing without fear of making mistakes plus the added contribution of being in and working in a group. The team spirit also strengthens the sense of belonging to the group which has positive effects on the creation of a learning environment where children feel safe, beloved, supported and capable.

Educational Robotics is an inclusive tool by definition, proposing other paths to access knowledge, backed by group activities. Students help or are helped by peers to discover their own abilities and the abilities of others.

The use of robotic tools facilitates team learning. In peer groups or as a school class, students have the opportunity to discuss freely and to propose solutions in what it is called 'proximal learning'. The typical context is a game, creating possibilities among pupils. In education, robots fulfil learning targets more quickly, accurately and successfully, allowing teachers to concentrate on character and competence building for students.

Through engagement Educational Robots can foster positive emotional states and social relationships that promote the creation of positive learning attitudes and environments, which improves the quality and depth of a student's learning experience. Carrying out increasingly complex tasks increases self-confidence and abilities and therefore increases self-esteem.

The most important role of early year's educators and parents in fostering learning is to provide the stimulation and encouragement to help children develop and practice their own thinking, to learn by DOING, to make mistakes, to learn from them (Popat Vats, 2019).

Roles

During the PEARL piloting we have also experienced how assigning roles impact the communicational and inclusive dynamics of the group. Relational Dynamics (Lee, Mazmanian and Perlow, 2020) is an approach that draws on theories and tools from a wide and eclectic range of sources, including person-centred coaching, psychology, emotional intelligence, NLP and contemporary research into leadership and modern-day communications.

For simplicity, it can be said that relational dynamics is the art of interaction with self and others (Relational Dynamics 1st, 2021). The interaction can be: a) One to one; b) One to two; c) one to three, etc., and both mutual and one way (Johnson, 2017).

By growing the number of members in a group, the number of interactions is growing as well. One of the easiest ways to describe the interaction between or among the members is to use a sociogram. When children are working in groups, they are working cooperatively. Cooperative learning is a form of collaborative learning in which the group works together to maximise their own and each other's learning (Murray, 2015). In cooperative learning, the development of social skills is significant. Therefore, the groups are formally structured, and each person in the group is assigned a particular role. (EduTech Wiki, 2021) summarises the list both of general and specific group work role models in education.

Assignment of the role to the children can be done in several ways: a) at random; b) a role selected by a teacher; c) children themselves assign a role:

> a) Random assignment – e.g. by choosing a coloured piece of paper or a ticket from a jar with a particular sign for the role.

> b) Teacher assigned roles – the teacher strategically decides on each role in a group.

> c) Self-assigned roles – the children choose their roles. There is the possibility that the same role frequently will be selected by the same child. However, the teacher knows his/her class best, and there may be occasions when a self-selected group is a good option.

The procedure for defining the roles usually includes several steps. In short, it can be fixed in two stages: at first, the definition of the roles that are needed for (learning) goals to be achieved and group dynamics that is desired, then an explanation of roles to students. Typically, in an educational context, these roles do not define all the work that will be done. Roles instead ensure that each group member adopts a specific coordination task (EduTech Wiki, 2021).

Although the size of groups varies, there are still some considerations to consider, such as the children's age, experience, the nature of the learning activity, the time, materials available, etc. Activities with the roles facilitate emotional and academic development (Coggeshall, 2010). (Murray, 2015) points some benefits as well:

> a) By assigning the role to the child, he/she is obliged (to some extent) to participate in the activity. It leads to more efficient learning because the child takes his/her responsibility to take part in the activity.
> b) Assignment of the role provides the structure, rules and mutual agreements that everyone tries to follow. It helps the children learn self and social awareness, trying to understand themselves and others.
> c) Each role represents different actions to do. Therefore, a child can try different roles and put himself into another person shoes. It fosters an empathetic approach to others.
> d) Activities with roles incorporate learning through a dialogue among children in a social setting, which requires them to communicate and express themselves.
> e) Finally, the roles enhance the ways to involve children with special needs (including learning disabilities and attention deficit disorders). It is an excellent opportunity to implement personalised learning.

Based on research (Social Sciences, 2021), the benefits of assigning roles can be categorised into four groups:

a) Social benefits - promotes social interactions, helps develop oral communication skills, gives the chance to teach and learn desired/appropriate behaviours and other social skills.

b) Psychological benefits – enhance student satisfaction with the learning experience, develop interpersonal relationships among students, helps to build student self-esteem, higher self-efficacy, creates a safe, nurturing environment, promote an encouraging environment.

c) Academic benefits - verbalisation plays a significant role in task solution. Thus it helps them develop concepts; there is more potential for success when students work in groups. Individuals tend to give up when they get stuck, whereas a group of students is more likely to find a way to keep going.

d) Assessment benefits - It provides instant feedback, helps to detect misconceptions early enough to correct them, use more authentic assessments such as observation, peer assessment, and writing reflections that can be incorporated, ensures individual accountability.

In order to find out children's relational communication patterns, their natural behaviour towards their classmates and the dynamics of inclusion and exclusion within a group we designed a graphic representation of it. It is based on Moreno (1951) sociometry and adapted by the educational psychologist Sonsoles Perpiñán for this project purposes.

The circles correspond to pupils and the arrows identify the communication and relational patterns among them. The wider the line, the more frequent the interaction is.

For designing the graphical representation, we started from a double entry table that allowed experts to count the number of interactions among children working in group while developing the PEARL pilot.

This table is only an example, and it was used by the observer to count the number of interactions among children in order to help the expert for creating the design with arrows						
	CHILD 1	CHILD 2	CHILD 3	CHILD 4	CHILD 5	INTERACTION WITH ALL AT ONCE **
CHILD 1 (ACTOR)*		I 1	IIII 4	IIII 4	II 2	III
CHILD 2 (REFEREE)*	I IIIII 6		II 2	I 1	0 0	III
CHILD 3 (TRAINER)*	IIIIIIIII 9	IIIIIII 7		IIIIIIIIIIIII I 15	IIIIIIIII 9	IIIIIIIIIIIIIII
CHILD 4 (SPEAKER)*	IIIIIIIIIIIIIIII 16	IIIIII 6	IIIIIIIIII I 11		IIIIIIIIII I 11	IIIIIIIIIIII
CHILD 5 (GUARDIAN)*	IIIIIIIIIIIIII 15	III 3	IIIIIIIII 9	IIIIIIIIII 10		IIIIIIIIIII
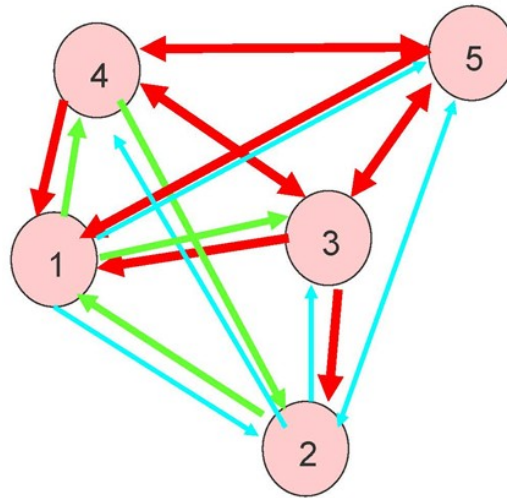
The clue elements of PEARL educational model are related and influence on one another. The following graphic represents PEARL model in a very intuitively and holistic view:
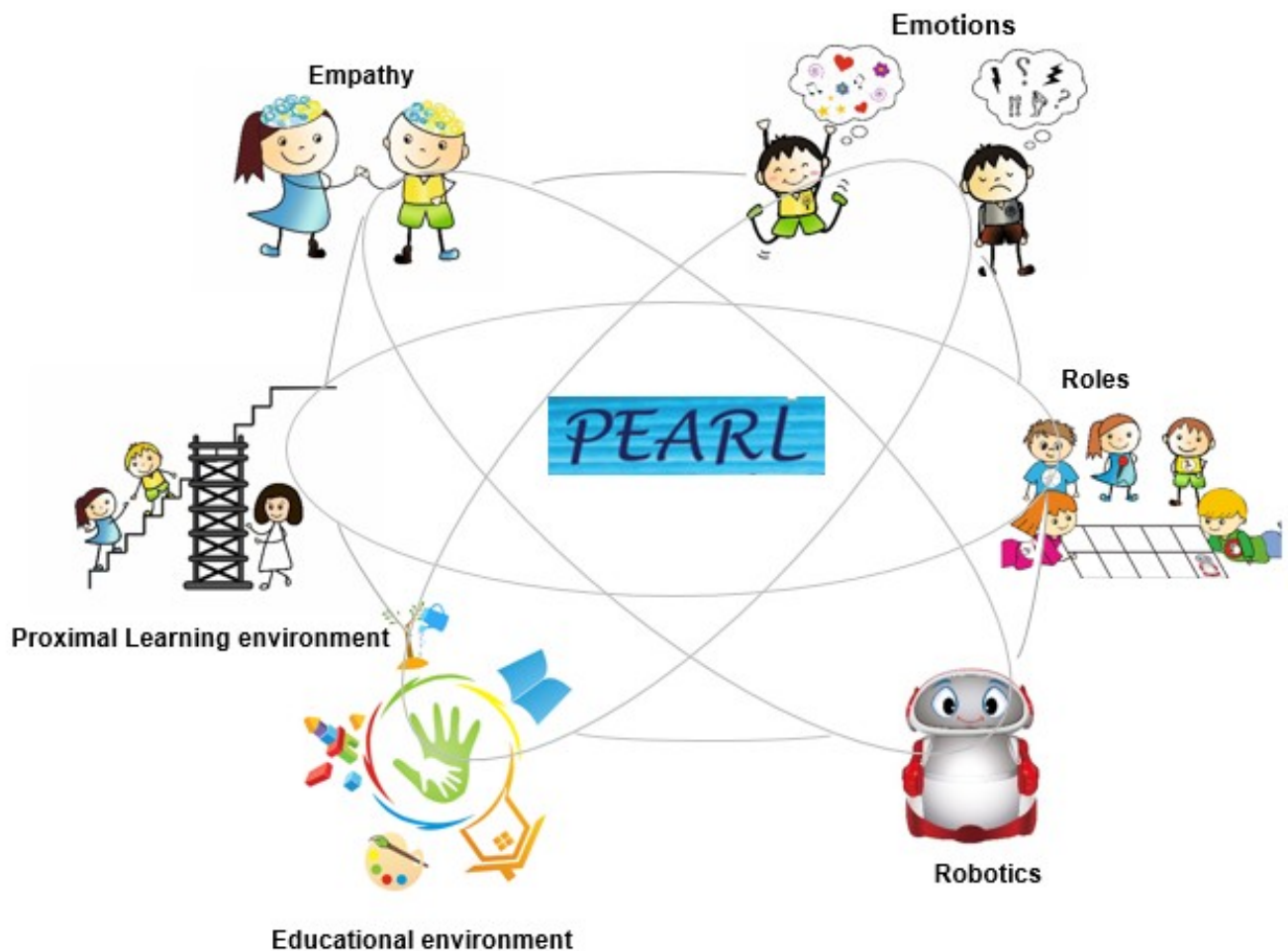
PEARL Model in a nutshell

The symbiosis of the 6 pillars of PEARL has facilitated the emersion of a synergic concept: Emotional, emphatic proximal learning Educational Environment, a scenario where children feel in a good position and in a place where they feel respected and beloved, where sharing is the base of educational emotions.

The main aim of educational emotion is to create a horizontal society where everybody has a meaningful place, where human rights and prosocial values are enhanced, respected and developed.

Stay and learn together is a much bigger and fastest process than doing it individually because working in group increases the range of emotions felt by the individual.

PEARL model puts the group, the relationships between peers and the development of emotions as the centre of its action for the creation of a proximal learning environment

PILOTING AND ASSESSMENT PROCESS AND RESULTS

PEARL educational project's piloted activities

The activities for the experimental research of PEARL Education Model are linked to the PEARL Model Foundations, this is, based on Piaget's learning approach, Vygostsky's zone of proximal development, Montessori's use of materials, and creation of environments, active learning, and Bandura's theories.

Constructivism approach explains what is knowledge and how it is learning (Erdem Demirel, 2002). It supports a child's structuring of the knowledge with his/her own mechanism in the process, in which she or he is involved by experiencing, rather than memorizing ready-made information (Perkins, 1999). Active participation children in their own learning processes and constructing knowledge by experience make learning permanent (Cole and Wertsch, 1996)

Concrete experiences and well-designed material make it easy for children to construct knowledge. Moreover, teachers, who acquired the scaffolding method well, guide and aim to support children´s developmental potential.

The Montessori's approach adopts a philosophy urging that every child should be provided with his/her own sovereignty and freedom. It is a child-centred approach allowing children to learn at their own pace. In the Montessori approach, it is emphasized that five senses should be at work actively in learning (Koh and Frick, 2010).

Active participation of children in the activities; the activity to be a challenge so it could potentially stir emotions, feasible to be performance either by individuals or group and adaptable to the use of a robot.

The universal design for learning was also a priority, so the activity should be potentially accessible to all children.

Under these basic features each project partner developed example activities that were shared in the consortium. A coordinator partner developed a template so each country could examine and score in terms of compliance with the basic criteria and applicability for each activity proposed by the rest of the project partners. The activities with the highest scores on those criteria were the ones selected to be used in the pilot study.

The activities developed by the team of Lithuania for 0-2 years range was resubmitted to revision and so was done for the activities developed by the team of Spain for 3-4 and 5-6 years ranges. Revisions and improvements for the selected activities were discussed in online meetings.

In 0-2 age group activities children use blocks to make patterns. The teacher shows how to build a structure of wooden blocks with colours and asks the child to copy his/her block form. Research (Ellis-Rech et al. 2020) indicates that early experiences with blocks stimulate the development of spatial, language, cognitive and problem-solving skills. No robot is used in this age group activities. Children perform the activities integrated with nature. The complete description of the activity and materials are available in this link: https://pearl-project.org/es/english-kit-1-phase-piloting-0-2-years-old-2/

3-4 year and 5-6 year group activities have two different versions: "activities with robot and activities without robot". In the activity without robot, the activity goes on

routinely and then ends. In the activity with robot, the robot is included at the last section of the activity, thus, children are expected to perform the tasks, they fulfilled at the beginning of the activity, through a robot this time. Both the activities with robot and those without have been designed to be run individually and in group.

The activity in the 3-4 age children is linked to phonological awareness working it from oral language and using pictograms. Children will try to form three word sentences with picture and pictograms sentence cards in 3-4 age activities without robot. On the other hand, in 3-4 age activities with robot, children were requested to collect the picture cards related to the sentence determined on the platform via a robot by revealing the robot platform consisting of picture sentence cards and coding the robot after studying with sentence cards. The complete description of the activity and materials are available in this link: https://pearl-project.org/es/english-kit-2-phase-piloting-3-4-years-old/

The 5-6 age activity is based on the mathematical logic and numerical composition and decomposition. During group activity without robot, children make compositions by means of cards with a number and a Dino picture representing that number. For example, by showing the card with the picture of 8 Dino on it, they answer the question "Which Dino cards do we put together, Can we obtain 8 Dinos?" by trying to find related Dino cards. In the version of this activity with robot, children are expected to collect the picture cards on the platform via a robot by revealing the robot and the robot platform with Dino cards having some numbers, for example, by coding the numbers to form 8 Dino cards on the robot after performing addition studies with Dino cards. The complete description of the activity, instructions and materials are in available at https://pearl-project.org/es/english-kit-2-phase-piloting-5-6-years-old/

Implementation Process of PEARL Educational Project's piloted activities

First Pilot study process

In order to achieve quality in the pilot studies, introductory meetings were initially held with preschool teachers, parents and other people working in public institutions related to preschool education. In addition, the teachers who participated in the pilot study were given training in Spain on constructivist learning approach, project process, activities, and assessment.

The activities developed under the PEARL Education Model were first translated to the language of each country. In the first stage, Doc Robot was provided to the schools where pilot study would be conducted, and the activities were explained in detail by giving an online training to the practicing teachers at the schools. After completing teacher's training, the implementation of the piloting activities in the schools started.

For 0-2 age group, pilot countries were Italy and Lithuania. They started with a single child running an activity enriched with nature materials. The same activity was forwarded to a different group of children.

All the project partners run pilot activities with children aged 3 to 6 years old. The experimental groups implemented the activities with a robot, while the same activities were performed without a robot in the control groups.

The activities with robot and without robot were run individually and also in group. During the first pilot study all experimental and control groups implement the activity

twice, the first day it was run without assigning any role in the group and the second day assigning roles to each member of the group. All sessions were video recorded.

The second piloting study process

Prior to the second pilot study teachers participated in an international online training on the project goal and process, observation forms, activities to be implemented, and filling in observation forms. In addition to this, the teachers were also trained locally, in their native language by the national project team, and detailed information meetings were held. After the training teachers were provided the needed materials for running the activity, including a robot.

The second phase of the PEARL Education Model was carried out with the 3-6 and 5-6 year old children in all the projects partners' countries, that is Italy, Lithuania, Spain and Turkey. In all the participant countries a robot was integrated into the activities developed under the PEARL Education Model for the experimental groups, while the same activities were performed without a robot in the control groups. The teachers, who received the activities and materials, run activities to some of the groups of five students with robots and some without robots. Teachers video recorded their sessions and filled-in the observation forms. The researchers in the project team supported teachers all along the implementation and assessment process..

After completing the second piloting phase, all teachers had the opportunity of creating different activities inspired by those in the pilot, and under PEARL Educational Model. These activities have been collected and conform the toolkit that is available on the project website.

Methodology

Research Design

The PEARL Education Model was carried out with a random quasi-experimental research model with a post-test control group. This experimental model features to establish randomly created experimental and control groups and to determine the effectiveness of the model by a post-test (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz and Demirel, 2016).

Experimental design and Population of Study

The experimentation was divided in 2 phases and the first population of the study was created for the pilot study:

- From mid November 2020 until the end of January 2021. Deep analysis of the impact of the facilitator elements (nature and robots) in the development of an inclusive and empathic proximal learning environment

  Experts in psychopedagogy field analysed the video recordings of the experimental sessions identifying the relational communication patters as well among children, the natural behaviour of the children towards their classmates and the dynamic of inclusion and exclusion, offering a graphic representation of it. The graphic representation was inspired on Moreno (1951), reshaped, and adapted for getting significant information under this project purposes.
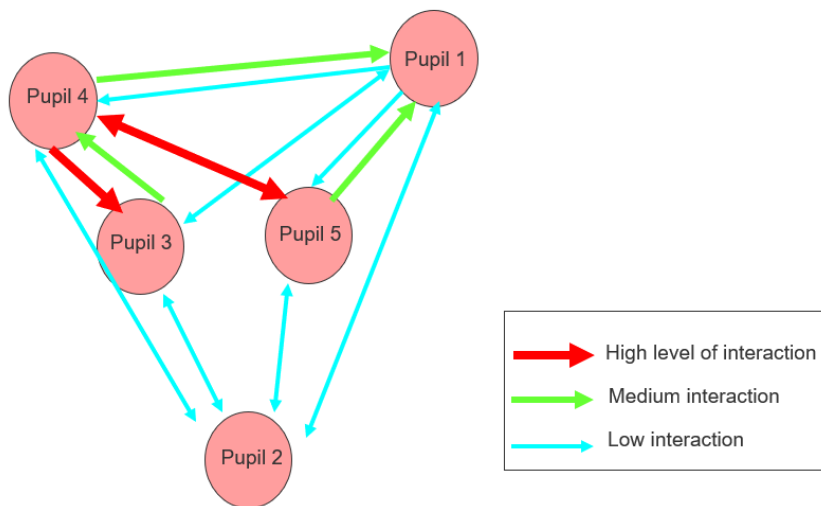
Communication and interaction can be bidirectional and it is represented by a double arrow.

Schools involved in the project voluntarily participated in the pilot study. Population was 12 children in the 0-2 year old age group from Italy and Lithuania, 48 children in the 3-4 year old age group and 48 children in the 5-6 years old age group. A total of **108 children** participated in the **first pilot study.**

Due to the inclusive characteristics of the project, children with special education needs participated in the experimental groups in which they worked with a robot.

In the pilot study, one experimental and three control groups were formed for the 0-2, 3-4 and 5-6 age group.

In the 0-2 age group, while the children performing group activity with materials of nature content created the experimental group, the children making individual activities formed the control group..

In the 3-4 and 5-6 age groups, the experimental and control groups were formed as follows:

- Group of 5 children running the activity with a robot (Experimental Group)

- Group of 5 children running the activity without a robot (Control Group)

- Single child running the activity with a robot (Experimental Group)

- Single child running the activity without robot (Control Group))

The experimental activities, when developed in group, foresaw a role assignment. They were run twice with each group, on the first day teacher would not interfere with the role assignment so children would be free to decide who plays each role. That way we observe more information about the emotional dynamics that occurs naturally. The second day, teacher would assign the roles, reserving the role of the actor to the child with special education needs.

- Mid-March 2021 until the end of May 2021: it consisted on a wider experimentation of the PEARL model.

In this phase, it was aimed to enlarge the number of children. Similarly to the population of the first pilot study, any child with special education needs was included in the experimental group with a robot.

Based on these purposes **the population was enlarged to 822 pupils** in Italy, Lithuania, Spain and Turkey; 407 participated in the activities with robots and 415 children performed the activities without using a robot.

With the experience gained in the first pilot phase, teachers were trained both in the PEARL model and in how to fill in the observation forms.

The division of experimental groups were reduced to:

- Control group- Group of 5 children running the activity with assigned roles and without a robot.

- Experimental group- Group of 5 children (one of them with special education needs) running the activity with assigned roles and with a robot.

Data collection tools and assessment tools

"PEARL Child Observation Form" was utilized to evaluate the children in the project.

The measurement tools serving to collect quantitative data were used to evaluate the effectiveness of the PEARL Education Model.

"PEARL Education Model Child Observation Form" was developed by the Gazi University project team. In order to write the items to be included in the PEARL Child Observation Form, the categories were specified based on the discussions made with the researchers in the project partner countries, project goals and literature (Beilin,1994; Cole and Wertsch, 1996; Erdem & Demirel, 2002; Ömeroğlu et al, 2015; Santrock, 2011a; Santrock, 2011b; Vygotsky,1978).

The categories selected to be measured by the observation forms were communication, group communication, cooperation, expressing emotions, expression oneself, solidarity, coping with challenges, creating strategy, following rules, achieving goals, understanding and managing positive and negative emotions.

Based on these categories, items proper for 0-2, 3-4 and 5-6 age groups were written, and an item pool was created.

Observation forms were later shared with the project partners, and their feedback was received regarding content, organization and face validity. Forms were revised upon the feedback of the project partners in adding items related to educational emotions (well-being, motivation, expressing emotions and prosocial behaviours) to the observation forms. In addition, forms were finalized by including demographic questions regarding ages and countries of children upon the views of the project partners. The observation forms developed for 0-2 age are provided below:

- Child observation form for activities performed by a single child by integrating natural materials.
- Child observation form for activities performed by children in a group environment by integrating natural materials.

The observation forms developed for 3-4 and 5-6 years old:

- Child observation form for activities performed by a single child without a robot.
- Child observation form for activities performed by a single child with a robot.
- Child observation form for activities performed by a group of 5 children without a robot.
- Child observation form for activities performed by a group of 5 children with a robot.

Therefore, a total of 10 observation forms, two for 0-2 age, four for 3-4 age, and four for 5-6 age, were developed.

The observation forms consisted of minimum 9 and maximum 51 items. Some of the items in the forms are designed for positive-desirable, while others are for negative-undesirable behaviours. All items in each form are rated Likert type between "0" and "10". Absence of a behaviour is referred to "0", while performance of a behaviour at the highest level is evaluated as "10". For example, If "0" is marked for the item "He/she invites teacher to participate in the game", this means that the child has never invited his/her teacher to participate in the game. On the other hand, if "10" is marked for the same item, this refers that the child has frequently invited his/her teacher to participate in the game.

Data Analysis and Results

Descriptive statistics were utilized in the assessment of the data obtained in the pilot study and the second phase of the project.

First Pilot study

After completing the first pilot study, each project partner appointed two experts in the field of psycho pedagogy and early childhood in order for them to observe the sessions recorded and to fill in the observation forms. The same activity run and recorded in the piloting was watched by two separate observers, and then the Child Observation Forms were filled in.

The data obtained from the forms were assessed descriptively. The mean score was obtained by averaging the scores of the observation forms, filled by each observer on country basis and in total for children aged 0-2, 3-4 and 5-6, in the SPSS environment, and provided as the mean score in the tables. Moreover, the scores obtained from each of the items of the Child Observation Form by children aged 0-2, 3-4 and 5-6 years were demonstrated with graphics according to the countries.

Second Pilot study

After completing the second piloting study the video recording of each child was watched by his/her teacher, and they were assessed with the Child Observation Forms developed for the project. The Child Observation Forms filled in by the teachers were hand-delivered by the researchers. The data was assessed descriptively utilizing SPSS. The child observation form scores were averaged for each country and in total to obtain the mean score, and these were provided as the mean score in the tables. In addition, the scores of children aged 3-4 and 5-6 years obtained from each of the items of the Child Observation Form were shown with graphics according to the countries.

Data Analysis and Results of the first Pilot Study

Pilot study was performed with the 0-6 aged children in the project schools in Italy, Turkey, Spain and Lithuania. The pilot study was conducted with children aged 0-2 in Italy and Lithuania, and children aged 3-4 and 5-6 in Italy, Turkey, Spain and Lithuania.

Table 1: Distribution of the child observation form item mean scores of the single children aged 0-2 by countries

	Italy	Lithuania	Total
	Mean	Mean	Mean
He/she asks the teacher's help when having difficulty during the activity	1,00	0,00	,50
He/she gets angry when failed	0,00	0,00	0,00
He/she loses interest in the activity when failed	6,00	0,00	3,00
He/she gets excited when confronting a new thing during the activity	3,00	0,00	1,50
He/she shows that he/she enjoys the activity	4,00	5,00	4,50
He/she invites teacher to participate in the game	10,00	0,00	5,00
He/she imitates the teacher during the activity	7,50	3,50	5,50
He/she finishes the activity happily	4,50	8,50	6,50
He/she cries when having difficulty during the activity	0,00	0,00	0,00
He/she expresses positive/negative feelings about nature and living creatures with a gesture, facial expression, and tone of voice	3,50	9,00	6,25
He/she focuses on nature's materials used in the activity	4,00	10,00	7,00
He/she enjoys using nature's material used in the activity	5,00	10,00	7,50
He/she gets excited towards nature's materials used in the activity	3,50	0,00	1,75
He/she creates new games with nature's materials used in the activity (mud houses, bird's nests from a tree branch)	5,00	0,00	2,50
He/she is interested in the materials used in the activity	3,50	10,00	6,75
He/she enjoys playing with the materials used in the activity	4,50	10,00	7,25
Item total mean scores	4,06	4,13	4,09

When examining the total score mean of the Child Observation Form items of the 0-2 age single children by countries (Table 1), it has been determined that the child in Lithuania has a higher score (4,12). It has been observed that a total of two children who participated in the activity individually, have obtained scores of 7 and above from the following items: *"He/she focuses on nature's materials used in the activity, He/she enjoys using nature's material used in the activity,*

He/she enjoys playing with the materials used in the activity". They have been observed to obtain scores below 2 from the items "He/she asks the teacher's help when having difficulty during the activity, He/she gets excited when confronting a new thing during the activity, He/she gets excited towards nature's materials used in the activity". As can be seen in the findings, it can be argued that children's focus and use nature materials and their positive interactions are at a good level.

Table 2: Distribution of the child observation form item mean scores of the children aged 0-2 by countries

	Italy Mean	Lithuania Mean	Total Mean
He/she asks the teacher's help when having difficulty during the activity	,40	0,00	,20
He/she gets angry when failed	,30	0,00	,15
He/she loses interest in the activity when failed	1,00	0,00	,50
He/she gets excited when confronting a new thing during the activity	4,90	,90	2,90
He/she is happy in group work	2,40	3,50	2,95
He/she shows that he/she enjoys the activity	5,30	7,40	6,35
He/she invites teacher to participate in the game	,60	0,00	,30
He/she imitates the teacher during the activity	2,80	6,10	4,45
He/she finishes the activity happily	5,30	2,80	4,05
He/she cries when having difficulty during the activity	0,00	0,00	0,00
He/she expresses positive/negative feelings about nature and living creatures with a gesture, facial expression, and tone of voice	5,10	5,30	5,20
He/she focuses on nature's materials used in the activity	6,30	7,00	6,65
He/she enjoys using nature's material used in the activity	6,80	5,90	6,35
He/she gets excited towards nature's materials used in the activity	6,10	3,60	4,85
He/she creates new games with nature's materials used in the activity (mud houses, bird's nests from a tree branch)	5,30	6,10	5,70
He/she is interested in the materials used in the activity	6,60	5,90	6,25
He/she enjoys playing with the materials used in the activity	6,70	7,00	6,85
He/she expresses others' positive/negative feelings with a gesture, facial expression, and tone of voice	5,90	4,50	5,20
He/she performs his/her role in group work	,50	3,10	1,80
He/she gets angry when he/she cannot fulfill his role in the group	0,00	0,00	0,00
He/she has difficulty communicating with the children in the group at the activity	6,80	0,00	3,40
He/she angers his friends because of his misbehavior in the group	2,50	,50	1,50
He/she plays together with classmates	1,60	2,10	1,85
He/she observes classmates during the activity	2,30	6,70	4,50
He/she communicates positively with the children in the group at the activity	2,50	,90	1,70
He/she shares toys during the activity	1,80	2,00	1,90
He/she collaborates with friends in the group	2,10	2,20	2,15
Total mean score of the items	3,40	3,09	3,25

When examining the total mean scores of the children aged 0-2 (Table 2), it has been found that the children in Italy have a higher mean score (3,40). They have been determined to obtain scores above 6 from the following items: *"He/she shows that he/she enjoys the activity, He/she focuses on nature's materials used in the activity, He/she enjoys using nature's material used in the activity, He/she is interested in the materials used in the activity, He/she enjoys playing with the materials used in the activity"*. In addition, the average score is below one from the items *"He/she asks the teacher's help when having difficulty during the activity, He/she gets angry when failed, He/she loses interest in the activity when failed, He/she invites teacher to participate in the game"*. When examining the findings, it is seen that 0-2 age group children enjoy playing with nature materials together with their peers. We can also see

that children do not have any difficulty when playing with these materials and have not had any situation such as failure that may affect their development negatively.

Based on these findings, it can be urged that the project hypothesis "Group activities enriched with natural materials improve children's social skills, cooperation skills, and ability to understand and express emotions" has been confirmed in the pilot study.

Table 3: Distribution of average child observation form item scores of 3-4 year old single children by country

	Italy		Lithuania		Spain		Turkey		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she is willing to participate in the activities	8,50	1,50	9,50	10,00	6,50	8,00	8,00	7,00	8,33	7,25
He/she is anxious when starting the activity	6,00	10,00	4,50	0,00	2,00	4,50	2,25	2,25	3,58	3,17
He/she does not lose interest during the activity	10,00	4,00	10,00	10,00	7,50	9,00	8,75	7,00	9,17	7,83
He/she has difficulties to follow teacher's directions	4,50	10,00	1,25	4,00	1,50	,50	,50	,50	1,58	3,25
He/she endeavours to carry on the activity	5,50	1,00	8,25	8,25	8,00	9,00	8,75	8,00	7,92	7,08
He/she wants to quit the activity when confronts a difficulty during the activity	,50	5,00	0,00	0,00	1,50	,50	,50	,50	,50	1,08
He/she is willing to deal with the difficulty confronting during the activity	3,50	0,00	5,00	7,00	4,00	8,50	6,25	5,75	5,00	5,67
He/she becomes upset when having difficulty during the activity	3,00	0,00	0,00	,75	2,00	3,50	2,00	1,75	1,50	1,42
He/she becomes happy when dealt with difficulty during the activity	5,00	0,00	8,75	9,00	2,00	8,00	2,75	,75	5,00	4,58
He/she expresses negative feelings with a gesture, facial expression, and tone of voice when confronts a difficulty during the activity	5,50	9,00	8,75	0,00	5,00	1,00	3,00	2,25	5,67	2,42
He/she gets angry when having difficulty during the activity	3,50	0,00	0,00	0,00	1,00	,50	0,00	,25	,75	,17

	Italy		Lithuania		Spain		Turkey		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she becomes happy after completing the activity	5,50	0,00	8,50	8,50	4,00	9,50	5,00	2,25	6,08	5,17
He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity	6,50	0,00	8,75	8,50	4,00	5,00	3,75	5,25	5,92	5,42
He/she asks for others' help when having difficulty during the activity	5,50	10,00	9,00	0,00	1,50	3,00	4,50	3,50	5,67	3,33
He/she is willing to experience new activities	8,00	0,00	5,00	3,75	6,00	9,50	8,25	4,00	6,75	4,17
He/she shows willingness to complete the activity	9,00	0,00	8,75	9,50	7,00	9,50	8,75	6,50	8,50	6,92
He/she gets angry when making a mistake	3,50	0,00	0,00	0,00	,50	,50	0,00	,25	,67	,17
He/she smiles often during the activity	2,00	0,00	5,75	5,25	1,50	8,50	2,00	2,75	3,17	4,08
He/she gets excited when produces new ideas or things during the activity	4,50	0,00	6,00	5,50	1,50	7,50	3,50	,25	4,17	3,17
He/she shows sadness when making a mistake	2,00	2,50	1,75	0,00	1,50	2,00	2,00	,25	1,83	,83
He/she leaves the game when gets angry	0,00	0,00	0,00	0,00	,50	0,00	0,00	,25	,08	,08
He/she shows courage when starting a new activity	7,00	5,00	5,75	7,00	7,50	9,00	5,00	7,00	6,00	7,00
He/she practices willingly the roles given during the activity	5,00	0,00	0,00	0,00	0,00	0,00	9,00	8,75	3,83	2,92
He/she tries different ways to solve the issue when having difficulty during the activity	10,00	0,00	8,25	6,00	7,00	8,50	6,00	1,75	7,58	4,00

When the total mean scores of 3-4 year old single children obtained from the items of the Child Observation Form by country are examined (Table 3), we discovered that the child in Spain has the highest mean score in the activity without robot, while the child in Italy has the lowest mean score. In the activity with robot, it has been determined that the child in Italy has the highest mean score, whereas the child in Spain has the lowest mean score. The total mean score difference between the single children with robot and without robot is determined to be the highest in Italy in favour of the child with robot and the highest in Spain in favour of the child without robot.

A total of four children with robot have been identified to have the mean score above seven from the items *"He/she is willing to participate in the activities, He/she does not lose interest during the activity, He/she endeavours to carry on the activity, He/she shows willingness to complete the activity, He/she tries different ways to solve the issue when having difficulty during the activity, He/she focuses on the materials (robot) used in the activity, He/she enjoys using materials (robot) used in the activity"*.
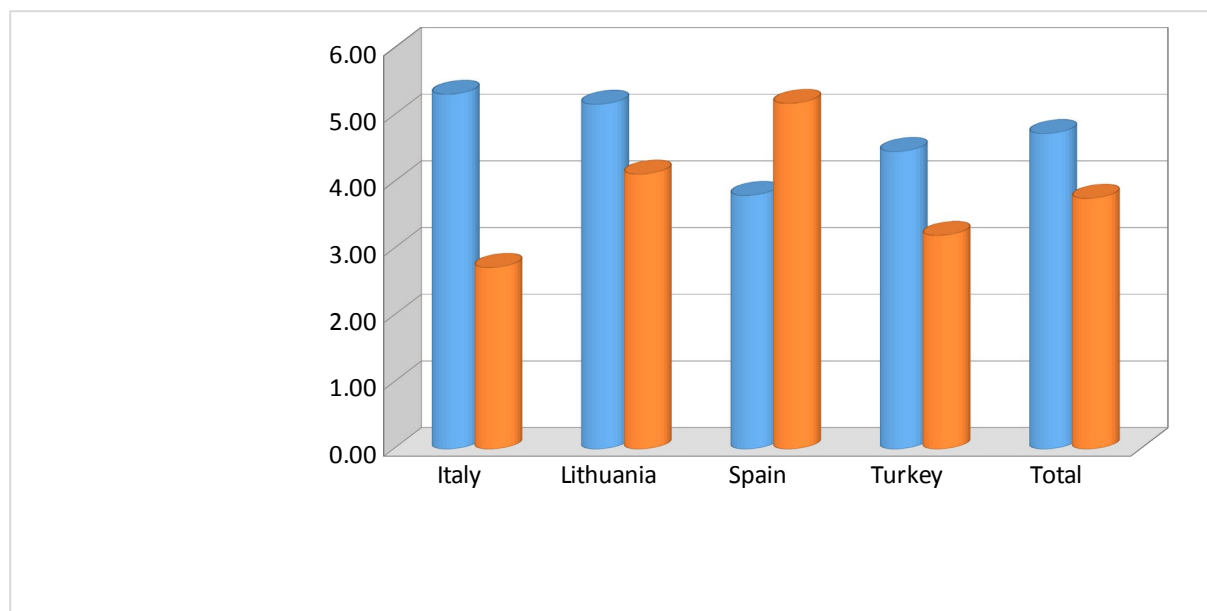
Figure 1: Country-specific graph of the distribution of the total average score of 3-4 years of age single children from the items of the Child Observation Form

In general, it has been determined that the total mean scores of the children with robots in the countries (Figure 1) are 4.73, higher than the mean scores of the groups without robots (3.76).

Table 4: Distribution of Child Observation Form item score averages of children in 3-4 age group by Country

	Italy		Lithuania		Spain		Turkey		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she is willing to participate in the activities	7,35	2,85	9,50	8,60	8,50	8,05	9,00	6,35	8,59	6,46
He/she is anxious when starting the activity	3,55	2,80	0,00	,50	5,90	6,30	1,35	,55	2,70	2,54
He/she does not lose	5,90	1,25	9,55	7,35	8,85	8,45	8,75	7,40	8,26	6,11

	Italy		Lithuania		Spain		Turkey		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
interest during the activity										
He/she has difficulties to follow teacher's directions	6,55	6,65	,90	2,70	1,45	2,30	2,45	1,50	2,84	3,29
He/she endeavors to carry on the activity	7,75	2,70	9,30	6,80	7,75	8,40	9,05	7,40	8,46	6,33
He/she wants to quit the activity when confronts a difficulty during the activity	3,35	4,00	0,00	,50	,70	,95	1,60	,40	1,41	1,46
He/she is willing to deal with the difficulty confronting during the activity	4,80	,90	8,95	4,95	6,80	5,95	6,70	2,35	6,81	3,54
He/she becomes upset when having difficulty during the activity	2,40	,35	,25	,55	2,95	2,15	,40	,25	1,50	,83
He/she becomes happy when dealt with difficulty during the activity	3,50	1,40	9,95	7,90	7,00	5,00	7,10	2,40	6,89	4,18
He/she expresses negative feelings with a gesture, facial expression, and tone of voice when confronts a difficulty during the activity	5,30	1,20	2,00	1,45	1,75	2,35	2,35	,75	2,85	1,44
He/she gets angry when having difficulty during the activity	2,10	,25	0,00	,50	2,50	2,65	,30	,05	1,23	,86
He/she becomes happy after completing the activity	5,15	2,65	9,50	7,30	8,65	8,40	7,75	4,90	7,76	5,81
. He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity	4,25	2,75	9,80	7,65	8,20	7,00	8,35	5,45	7,65	5,71
He/she asks for others' help when having difficulty during the activity	3,75	1,15	1,00	,25	4,50	3,50	4,60	,90	3,46	1,45

	Italy		Lithuania		Spain		Turkey		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she is willing to experience new activities	6,75	1,35	9,35	7,50	9,25	9,00	8,85	1,90	8,55	4,94
He/she shows willingness to complete the activity	8,65	2,65	9,35	7,10	8,45	7,45	6,95	5,35	8,35	5,64
He/she gets angry when making a mistake	,60	,25	0,00	,25	2,10	2,05	,35	,10	,76	,66
He/she smiles often during the activity	2,20	2,00	7,85	4,15	8,55	5,25	5,80	5,00	6,10	4,10
He/she gets excited when produces new ideas or things during the activity	2,35	1,10	7,35	5,65	4,85	3,40	7,05	,15	5,40	2,58
He/she shows sadness when making a mistake	,80	,40	,55	,25	,60	,60	,25	0,00	,55	,31
He/she leaves the game when gets angry	1,90	2,25	0,00	,40	,35	,75	,40	,15	,66	,89

When examining the total mean scores that 3-4 year old children obtained from the items of the Child Observation Form by country (Table 4), we find that the children in Spain have the highest mean score in the activity without robot, while the children in Italy have the lowest mean score. In the activity with robot, we find that the children in Spain have the highest mean score, whereas the children in Italy have the lowest mean score. The mean score difference between the groups with robot and without robot is determined to be the highest in Italy in favour of the groups with robot and the least in Spain.

It has been concluded that all children participating in the activities with robot have mean scores above seven from the items *"He/she is willing to participate in the activities, He/she does not lose interest during the activity, He/she endeavours to carry on the activity, He/she becomes happy after completing the activity, He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity, He/she is willing to experience new activities, He/she shows willingness to complete the activity, He/she shows courage when starting a new activity, He/she is happy in group work, He/she focuses on the materials (robot) used in the activity, He/she enjoys using materials (robot) used in the activity, He/she gets excited with the material (robot) used in the activity"*.

Figure 2: The distribution of the total average score obtained by 3-4 age group children by country from the items of the Child Observation Form

When examining the total scores of the children in all countries (Figure 2), we find that the mean score of the group with robot is higher than the mean score of the group without robot.

Table 5: Distribution of the child observation form item mean scores of the single children aged 5-6 group by countries

	Italy		Lithuania		Spain		Turkey		Total	
	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she is willing to participate in the activities	5,50	4,00	10,00	10,00	9,00	5,50	7,25	7,00	8,17	7,25
He/she is anxious when starting the activity	4,00	8,00	0,00	0,00	4,00	6,50	,25	3,50	1,42	3,58
He/she does not lose interest during the activity	10,00	5,00	10,00	10,00	9,00	4,50	10,00	4,75	9,83	6,50
He/she has difficulties to follow teacher's directions	5,00	9,00	0,00	0,00	,50	8,50	2,75	1,75	1,83	3,50
He/she endeavors to carry on the activity	2,50	9,50	10,00	10,00	8,00	9,00	9,25	8,50	8,17	9,25
He/she wants to quit	0,00	5,50	0,00	0,00	,50	1,50	0,00	,75	,08	1,42

	Italy		Lithuania		Spain		Turkey		Total	
	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
the activity when confronts a difficulty during the activity										
He/she is willing to deal with the difficulty confronting during the activity	9,00	7,00	10,00	9,50	7,50	1,00	6,50	5,00	8,25	6,17
He/she becomes upset when having difficulty during the activity	0,00	4,00	0,00	0,00	,50	7,00	0,00	4,00	,08	3,17
He/she becomes happy when dealt with difficulty during the activity	7,00	0,00	8,25	9,75	3,50	1,00	4,50	1,50	6,00	3,92
He/she expresses negative feelings with a gesture, facial expression, and tone of voice when confronts a difficulty during the activity	0,00	9,50	0,00	0,00	3,50	7,00	,50	5,75	,75	4,67
He/she gets angry when having difficulty during the activity	0,00	1,50	0,00	0,00	4,00	1,00	0,00	,50	,67	,58
He/she becomes happy after completing the activity	6,00	0,00	9,00	10,00	5,50	4,00	2,50	1,25	5,75	4,42
He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity	6,00	2,50	8,25	10,00	7,50	1,50	3,75	4,50	6,25	5,50
He/she asks for others' help when having difficulty during the activity	0,00	10,00	4,50	3,75	7,50	6,50	5,75	,50	4,67	4,17
He/she is willing to experience new activities	6,50	2,50	9,50	9,50	4,50	1,50	7,75	3,50	7,58	5,00
He/she shows	10,00	8,50	10,00	10,00	6,50	3,00	5,25	2,50	7,83	6,08

|	Italy		Lithuania		Spain		Turkey		Total	
	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot	Single Child With Robot	Single Child Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
willingness to complete the activity										
He/she gets angry when making a mistake	0,00	1,00	5,00	0,00	4,00	,50	0,00	0,00	2,33	,25
He/she smiles often during the activity	3,00	0,00	5,75	6,75	3,00	,50	5,25	4,00	4,67	3,67
He/she gets excited when produces new ideas or things during the activity	1,00	0,00	6,50	6,50	2,00	1,00	3,25	0,00	3,75	2,33
He/she shows sadness when making a mistake	0,00	4,00	0,00	0,00	5,00	3,50	,50	3,00	1,00	2,25
He/she leaves the game when gets angry	0,00	0,00	0,00	0,00	,50	1,00	0,00	0,00	,08	,17

When examining the total mean scores of 5-6 year old single children obtained from the items of the Child Observation Form by country (table 5), we can see that the child in Lithuania has the highest mean score in the activities without robot, while the child in Turkey has the lowest mean score. In the activities with robot, we discover again that the child in Lithuania has the highest mean score, whereas the child in Turkey has the lowest mean score. The total mean score difference between the single children with robot and without robot is determined to be the highest in Spain and the least in Turkey in favour of the child with robot.

It has been observed that all children participating in the activities with robot have mean scores above seven from the items *"He/she is willing to participate in the activities, He/she does not lose interest during the activity, He/she endeavours to carry on the activity, He/she becomes happy after completing the activity, He/she is willing to experience new activities, He/she shows willingness to complete the activity, He/she focuses on the materials (robot) used in the activity, He/she enjoys using materials (robot) used in the activity, He/she gets excited with the material (robot) used in the activity".*
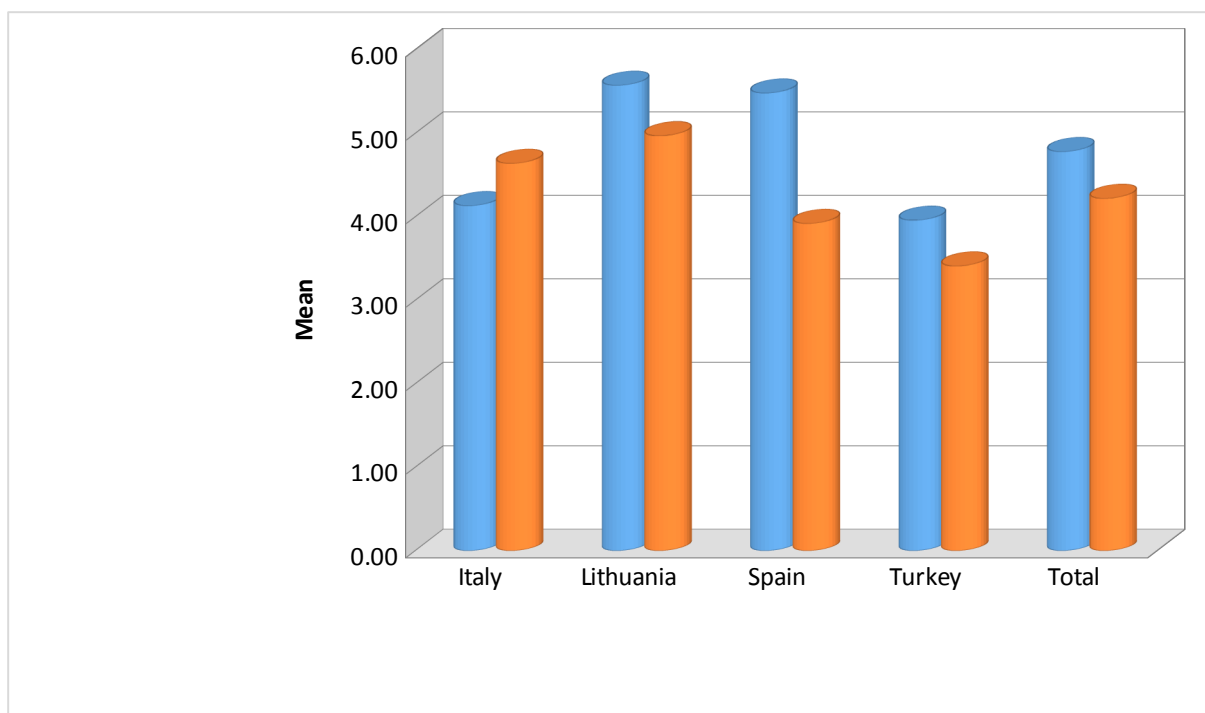
Figure 3: The graphic regarding the distribution of total mean scores obtained by the children aged 5-6 from the items of Child Observation Form by countries

When examining the total scores of the children in all countries (Figure 3), it has been identified that the mean score of the children with robot is higher than the mean score of those without robot.

Table 6: Distribution of the child observation form item mean scores of the children aged 5-6 group by countries

	Italy		Lithuania		Spain		Turkey		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she is willing to participate in the activities	6,85	6,73	9,70	10,00	7,60	7,45	8,40	7,45	8,14	7,99
He/she is anxious when starting the activity	3,65	2,67	0,00	0,00	5,15	5,65	,70	,45	2,38	2,16
He/she does not lose interest during the activity	6,70	7,67	9,25	8,75	7,45	7,85	7,45	7,75	7,71	8,03
He/she has difficulties to follow teacher's directions	3,60	3,93	,45	1,00	2,55	1,55	2,45	2,50	2,26	2,13
He/she endeavors to carry on the activity	5,30	5,33	7,95	9,25	7,40	6,40	7,65	7,70	7,08	7,29
He/she wants to quit the activity when confronts a difficulty during the activity	1,65	1,87	1,85	0,00	,95	1,50	,05	,75	1,13	,97
He/she is willing to deal with the difficulty confronting during the activity	4,40	5,33	6,75	8,60	5,10	5,15	4,40	4,80	5,16	6,01
He/she becomes upset when having difficulty during the activity	1,70	,60	,80	0,00	2,75	1,15	,05	,70	1,33	,61

	Italy		Lithuania		Spain		Turkey		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she becomes happy when dealt with difficulty during the activity	4,15	5,00	8,10	8,05	4,85	5,35	4,70	4,45	5,45	5,76
He/she expresses negative feelings with a gesture, facial expression, and tone of voice when confronts a difficulty during the activity	4,40	,93	2,90	2,10	1,50	1,30	0,00	2,70	2,20	1,81
He/she gets angry when having difficulty during the activity	1,75	,47	1,25	0,00	1,35	,45	0,00	0,00	1,09	,21
He/she becomes happy after completing the activity	6,50	6,27	8,70	9,25	7,45	7,50	5,35	4,75	7,00	6,99
He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity	6,40	5,87	8,30	9,30	6,50	5,05	6,10	5,75	6,83	6,53
He/she asks for others' help when having difficulty during the activity	,85	2,73	1,95	1,60	2,50	3,15	0,00	3,65	1,33	2,79
He/she is willing to experience new activities	6,90	5,80	7,70	9,55	8,20	8,65	7,25	5,65	7,51	7,52
He/she shows willingness to complete the activity	6,70	6,73	7,80	9,80	6,90	6,85	6,70	6,55	7,03	7,53
He/she gets angry when making a mistake	1,00	,60	0,00	1,00	1,00	,10	0,00	,35	,50	,51
He/she smiles often during the activity	5,50	5,87	5,90	5,80	4,45	3,75	5,25	5,25	5,28	5,12
He/she gets excited when produces new ideas or things during the activity	3,80	5,40	5,60	7,60	4,85	2,15	4,75	,05	4,75	3,69
He/she shows sadness when making a mistake	1,10	,47	0,00	0,00	,60	,35	0,00	0,00	,43	,19
He/she leaves the game when gets angry	,30	,53	0,00	0,00	,10	,35	0,00	,20	,10	,25
He/she shows courage when starting a new activity	4,45	5,20	6,95	9,60	6,70	6,70	6,85	1,95	6,24	5,91

When examining the total mean scores that 5-6 year old children obtained from the items of the Child Observation Form by country, we have found that children in Lithuania have the highest mean score in the activities without robot, while children in Turkey have the lowest mean score. In the activities with robot, it has been determined that children in Lithuania have the highest mean score, whereas children in Turkey have the lowest mean score. The mean score difference between the groups with robot and without robot is determined to be the highest in Turkey and the least in Italy in favour of the groups with robot.

It has been concluded that children participating in the activity with robot have mean scores above seven from the items *"He/she is willing to participate in the activities, He/she does not lose interest during the activity, He/she endeavours to carry on the activity, He/she becomes happy after completing the activity, He/she is willing to experience new activities, He/she focuses on the materials (robot) used in the activity, He/she enjoys using materials (robot) used in the activity, He/she gets excited with the material (robot) used in the activity, He/she shows willingness to complete the activity".*

Mean	Italy	Lithuania	Spain	Turkey	Total
■ Group With Robot	3,87	4,54	4,30	3,13	3,96
■ Group Without Robot	3,55	4,74	3,89	2,43	3,66
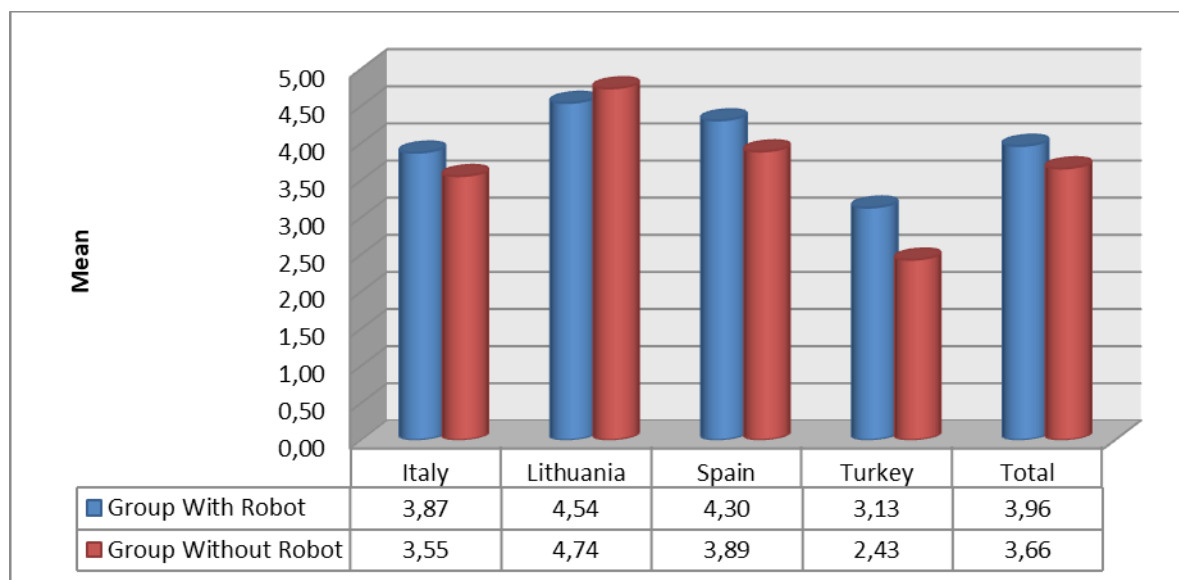
Figure 4: The graphic regarding the distribution of total mean scores obtained by the children aged 5-6 from the items of Child Observation Form by countries

When examining the total scores of the children in all countries (Figure 4), it has been identified that the mean score of children with robot is higher than the mean score of those without robot.

Based on these findings, it can be stated that the project hypothesis "Group activities enriched with robotic coding activities improve children's social skills, cooperation skills, and ability to understand and express emotions" has been confirmed in the pilot study performed with the children aged 3-4 and 5-6.

Results of the first pilot study

The project hypothesis "Group activities enriched with natural materials improve children's social skills, cooperation skills, and ability to understand and express emotions" has been confirmed.

Regarding children aged 3-4 and 5-6, the project hypothesis "Group activities enriched with robotic coding activities improve children's social skills, cooperation skills, and ability to understand and express emotions" has been confirmed.

Observation by experts has provided significant information about the interest of assigning roles or not within a group and its impact on communication and inclusion process. When there were no roles assigned in the group we observed individual social skills, natural leadership, communication skills, and inclusion and exclusion natural behaviours when a child could not follow the rhythm of the group, and how children negotiate rules.

When assigning roles, these roles stimulate individual potential, gave children the possibility of trying new situations, roles enhanced the group identity and eased inclusion. The differences in the group dynamics improved significantly, there were more communicative inputs among children, children with difficulties found their space, and it eased the emersion of their potentialities. All children both those extroverts and the shyer benefit from roles assignment.

Due to these conclusions, the second piloting study was only run assigning roles within the group.

Data Analysis and Results of the Second Piloting Study

The second phase of the PEARL project was carried out during May 2021 and it consisted of children in Italy, Lithuania, Spain and Turkey.

Table 7: Distribution of Child Observation Form item score averages of children in 3-4 age group by Country

	3-4 Age									
	Country									
	Italy		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she is willing to participate in the activities	8,0	7,6	8,9	8,4	9	8,9	8,2	8,2	8,6	8,3
He/she is anxious when starting the activity	1,4	2,6	2,5	2,3	8,6	8,4	4,0	3,9	4,4	4,4
He/she does not lose interest during the activity	6,5	4,6	6,6	6,8	7,6	8,1	7,0	7,2	7,0	7,0
He/she has difficulties to follow teacher's directions	4,3	3,3	2,6	2,4	3,2	4,4	4,2	4,6	3,6	3,8
He/she endeavours to carry on the activity	6,1	6,7	7,6	7,8	8,3	8,4	7,5	7,3	7,6	7,6
He/she wants to quit the activity when confronts a difficulty during the activity	2,1	2,8	2,7	3,2	2,2	2,4	3,4	3,9	2,8	3,2
He/she is willing to deal with the difficulty confronting during the activity	6,6	6,7	6,5	6,1	7,4	7,1	6,6	6,3	6,8	6,5
He/she becomes upset when having difficulty during the activity	3,4	3,0	4,4	3,9	2,4	2,7	4,1	4,6	3,7	3,7
He/she becomes happy when dealt with difficulty during the activity	6,0	4,6	8,5	7,9	7,3	7,7	3,2	2,1	5,9	5,3
He/she expresses negative feelings with a gesture, facial expression, and tone of voice when	5,3	6,0	6,6	6,7	3,8	3,7	5,4	6,4	5,3	5,8

	3-4 Age									
	Country									
	Italy		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she gets angry when having difficulty during the activity	3,1	3,3	2	1,8	2,2	2,2	3,6	4,9	2,8	3,2
He/she becomes happy after completing the activity	8,3	8,0	9,3	8,3	9,2	8,7	7,6	7,5	8,5	8,0
He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity	7,9	7,7	8,7	8,2	8,3	8	7,8	8,4	8,2	8,2
He/she asks for others' help when having difficulty during the activity	5,3	4,7	6,5	5,8	3,5	3,2	4,4	3,4	4,9	4,2
He/she is willing to experience new activities	7,5	7,3	7,9	6,6	8,8	8,6	7,8	8,3	8,0	7,8
He/she shows willingness to complete the activity	7,7	7,2	8,1	6,8	8,4	8,3	5,0	6,8	7,0	7,2
He/she gets angry when making a mistake	2,7	3,2	1,7	1,5	1,8	2,3	3,0	4,3	2,3	3,0
He/she smiles often during the activity	6,8	5,1	7,3	6,2	7,3	6,8	6,5	7,1	6,9	6,5
He/she gets excited when produces new ideas or things during the activity	6,3	6,6	7,9	7,5	7,6	7,4	5,5	7,3	6,7	7,3
He/she shows sadness when making a mistake	5,1	6,1	5,5	4	2,4	3,4	4,4	4,8	4,3	4,4
He/she leaves the game when gets angry	2,5	2,2	3,2	2,5	1,2	1,5	1,9	2,7	2,1	2,3
He/she shows courage when starting a new activity	6,9	6,4	7,9	7	7,9	7,5	7,1	7,7	7,5	7,3
He/she practices willingly the roles given during the activity	7,5	7,2	8,4	7,9	8,9	8,3	7,2	7,2	8,0	7,7
He/she tries different ways to solve the issue when having difficulty during the activity	6,2	4,9	7,3	6,6	5,5	6,3	6,0	6,6	6,2	6,3
He/she becomes anxious when confronts a difficulty	2,4	4,0	3,5	3,1	4,5	4,9	4,6	6,3	4,0	4,8
He/she is happy in group work.	7,3	7,1	8,3	7,7	8,5	8	7,1	7,6	7,8	7,7

	3-4 Age									
	Country									
	Italy		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she gets angry when he/she cannot fulfill his role in the group.	3,4	3,4	2,6	1,7	2,2	2,5	3,2	5,3	2,8	3,4
He/she angers his friends because of his misbehavior in the group.	1,3	2,8	2	2	1,8	1,7	2,3	3,4	1,9	2,5
He/she focuses on the materials (robot) used in the activity	7,4		8,7		8,7		7,7		8,2	
He/she enjoys using materials (robot) used in the activity	7,6		9,1		9,2		7,8		8,5	
He/she gets excited with the material (robot) used in the activity	7,2		9,4		9		7,5		8,3	
He/she creates new games with the material (robot) used in the activity	5,0		7,1		4,5		5,7		5,7	
He/she excitedly shares with the teacher experiences he/she had with the robot	5,9		8,9		7,3		6,7		7,3	
He/she expresses others' positive/negative feelings	6,7	5,7	7,4	7,1	7,4	7,2	7,6	8,0	7,4	7,3
He/she displays behaviors that disturbs the flow of the activity	3,0	2,4	2,4	1,8	3	3,4	3,1	4,5	2,9	3,2
He/she complains about classmates during the activity	2,8	3,3	7,7	5,6	6,4	5,2	5,6	5,8	6,1	5,3
He/she communicates positively with the children in the group at the activity.	1,5	3,5	1,5	1,1	1,8	1,4	2,2	4,0	1,8	2,5
He/she has difficulty communicating with the children in the group at the activity.	1,6	2,3	1,8	2	2,1	2	3,0	4,0	2,3	2,8
He/she collaborates with friends in the group	6,7	5,8	7,6	7,1	8,1	7,3	6,2	6,5	7,1	6,8
He/she cooperates with classmates	6,5	6,2	7,9	7,8	8,4	7	6,6	6,1	7,4	6,8
He/she enjoys helping classmates during the	6,1	5,7	7,9	7,3	7,7	7,1	6,9	6,3	7,3	6,7

	3-4 Age									
	Country									
	Italy		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
activity										
He/she stays calm when solving issues with others	6,8	6,9	6,8	7,1	8	7,6	6,5	5,4	7,0	6,6
He/she cares about classmates who are upset	4,4	4,8	6,2	4,4	5,3	6	5,4	5,9	5,5	5,4
He/she displays reluctance in participating in the group work.	1,6	2,6	1,8	1,2	1,6	2,5	2,2	2,2	1,8	2,1
He/she provides support to other children while they perform their role in the group work	5,6	5,6	7,4	5,8	6,8	6,7	6,1	5,9	6,5	6,0
Total points average	5,2	5	6,1	5,2	5,9	5,6	5,5	5,7	5,7	5,5

When examining the total mean scores of 3-4 year old children obtained from the items of the Child Observation Form by country (Table 7), we find that children in Lithuania have the highest mean score in the activity without robot, while children in Italy have the lowest mean score. In the activity with robot, we discover that children in Turkey have the highest mean score, whereas children in Italy have the lowest mean score. The mean score difference between the groups with robot and without robot is determined to be the highest in Turkey and the lowest in Italy in favour of the groups with robot.

It has been found that all children participating in the activities with robot have mean scores above seven from the items "He/she is willing to participate in the activities, He/she does not lose interest during the activity, He/she endeavours to carry on the activity, He/she becomes happy after completing the activity, He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity, He/she is willing to experience new activities, He/she shows willingness to complete the activity, He/she shows courage when starting a new activity, He/she practices willingly the roles given during the activity, He/she is happy in group work, He/she focuses on the materials (robot) used in the activity, He/she enjoys using materials (robot) used in the activity, He/she excitedly shares with the teacher experiences he/she had with the robot, He/she expresses others' positive/negative feelings, He/she collaborates with friends in the group, He/she cooperates with classmates, He/she enjoys helping classmates during the activity, He/she stays calm when solving issues with others, He/she gets excited with the material (robot) used in the activity".
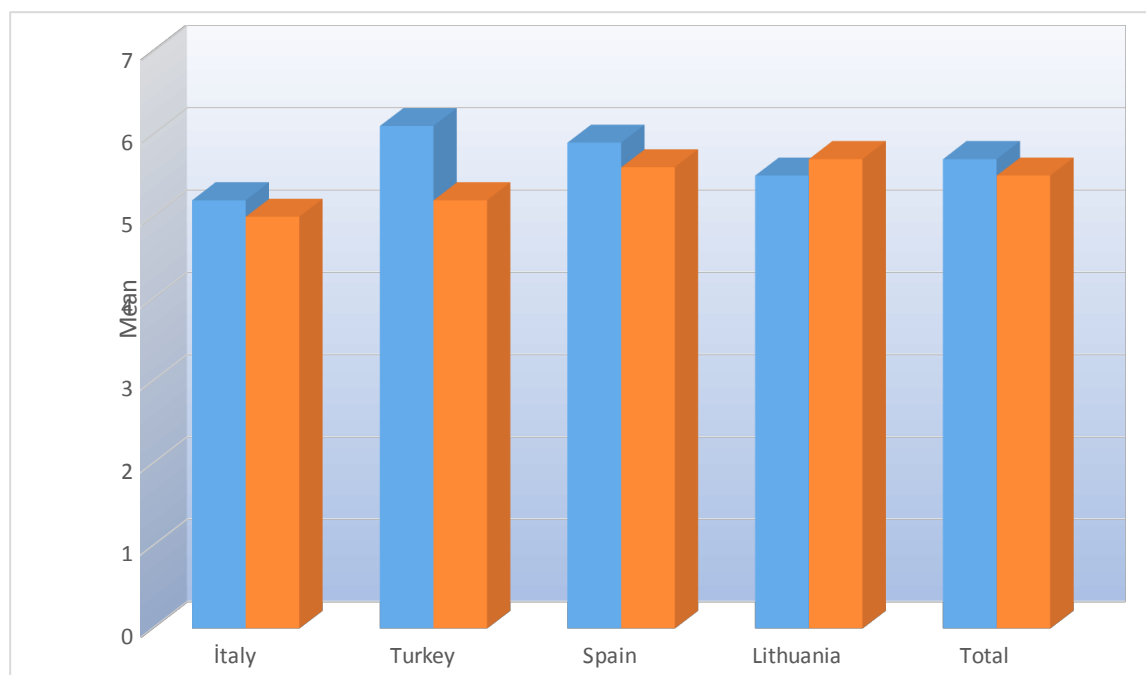
Figure 5: The graphic regarding the distribution of total mean scores obtained by the children aged 3-4 from the items of Child Observation Form by countries

When examining the total scores of the children in all countries (Figure 5), it has been identified that the mean score of children with robot is higher than the mean score of those without robot.

Table 8: Distribution of Child Observation Form item score averages of children in 5-6 age group by Country

	5-6 Age									
	Country									
	İtaly		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she is willing to participate in the activities	10,0	9,9	9,2	9,3	8,8	8,5	8,8	8,4	9,0	8,9
He/she is anxious when starting the activity	4,7	3,3	3,4	3,0	7,9	7,4	3,8	4,4	4,7	4,5
He/she does not lose interest during the activity	7,3	6,1	7,6	6,9	7,9	7,5	8,0	6,9	7,7	6,9
He/she has difficulties to follow teacher's directions	2,4	3,6	3,3	2,7	4,4	3,7	3,3	4,0	3,4	3,5
He/she endeavors to carry on the activity	7,3	8,1	8,1	7,8	8,5	7,5	8,1	7,6	8,1	7,7

	5-6 Age									
	Country									
	İtaly		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
He/she wants to quit the activity when confronts a difficulty during the activity	1,5	1,9	2,5	3,0	1,7	1,6	1,9	2,4	2,0	2,3
He/she is willing to deal with the difficulty confronting during the activity	8,4	7,9	7,0	7,0	7,1	6,6	8,0	6,8	7,5	6,9
He/she becomes upset when having difficulty during the activity	2,4	1,0	4,9	4,9	2,7	2,9	3,4	4,4	3,6	3,8
He/she becomes happy when dealt with difficulty during the activity	8,1	6,2	7,8	9,4	6,1	5,7	4,0	3,1	6,2	6,0
He/she expresses negative feelings with a gesture, facial expression, and tone of voice when confronts a difficulty during the activity	5,0	4,8	6,4	7,0	3,2	3,1	5,1	4,5	5,1	5,0
He/she gets angry when having difficulty during the activity	1,3	1,2	1,9	2,8	2,1	2,5	2,7	2,7	2,2	2,5
He/she becomes happy after completing the activity	9,4	7,2	9,1	9,3	8,5	8,4	8,4	7,2	8,8	8,1
He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity	9,3	6,8	8,3	8,6	8,4	7,4	8,0	7,6	8,3	7,8
He/she asks for others' help when having difficulty during the activity	6,4	4,8	4,8	4,7	5,0	5,3	3,7	4,9	4,7	4,9
He/she is willing to experience new activities	9,2	7,5	7,3	7,8	7,5	8,0	8,5	7,8	8,0	7,8
He/she shows willingness to complete the activity	8,8	7,6	8,2	7,8	7,8	7,4	5,3	6,3	7,2	7,2
He/she gets angry when making a	2,3	1,2	2,0	2,9	2,3	3,0	1,5	3,2	2,0	2,8

	5-6 Age									
	Country									
	İtaly		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
mistake										
He/she smiles often during the activity	8,9	5,5	7,5	7,2	7,9	7,3	7,6	6,3	7,8	6,7
He/she gets excited when produces new ideas or things during the activity	8,2	6,4	6,7	8,5	7,7	6,9	6,6	6,2	7,1	7,1
He/she shows sadness when making a mistake	3,6	4,3	5,0	5,2	3,1	2,7	3,0	4,0	3,8	4,1
He/she leaves the game when gets angry	,1	,8	2,5	3,2	1,2	2,0	,9	1,7	1,4	2,2
He/she shows courage when starting a new activity	7,3	6,5	8,2	7,8	8,0	7,4	8,1	7,3	8,0	7,4
He/she practices willingly the roles given during the activity	8,6	7,4	8,4	8,6	8,6	7,8	8,5	7,5	8,5	7,9
He/she tries different ways to solve the issue when having difficulty during the activity	8,4	7,3	6,6	7,1	6,5	6,8	7,4	6,2	7,1	6,8
He/she becomes anxious when confronts a difficulty	3,9	2,8	4,4	4,5	4,2	4,3	4,5	5,6	4,3	4,6
He/she is happy in group work.	9,5	6,9	8,5	8,4	8,3	8,3	8,7	8,1	8,6	8,1
He/she gets angry when he/she cannot fulfill his role in the group.	2,2	1,0	1,8	2,9	1,9	2,4	2,1	3,6	2,0	2,8
He/she angers his friends because of his misbehavior in the group.	2,0	,4	2,0	2,3	1,6	1,0	1,7	1,8	1,8	1,6
He/she focuses on the materials (robot) used in the activity	8,8		9,5		8,5		8,1		8,7	
He/she enjoys using materials (robot) used in the activitY	9,6		9,7		8,9		7,4		8,7	
He/she gets excited with the material (robot) used in the activity	9,5		9,3		8,8		8,5		9,0	
He/she creates new	4,1		5,6		3,3		5,6		4,9	

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	5-6 Age									
	Country									
	İtaly		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
games with the material (robot) used in the activity										
He/she excitedly shares with the teacher experiences he/she had with the robot	8,9		6,6		6,6		6,7		6,9	
He/she communicates positively with the children in the group at the activity.	7,5	7,1	8,2	7,5	7,9	7,8	8,3	8,1	8,1	7,7
He/she has difficulty communicating with the children in the group at the activity	2,4	3,8	2,3	1,8	1,4	1,7	2,9	2,9	2,3	2,3
He/she expresses others' positive/negative feelings	3,1	1,8	4,6	5,8	6,3	6,3	5,0	4,1	4,9	4,9
He/she displays behaviors that disturbs the flow of the activity	1,2	2,0	1,7	2,5	1,8	1,2	2,7	2,3	2,0	2,1
He/she complains about classmates during the activity	1,1	,6	1,9	3,3	1,5	2,2	2,7	2,0	2,0	2,3
He/she cooperates with classmates	7,8	6,5	8,3	8,2	7,7	7,8	7,6	7,4	7,9	7,7
He/she collaborates with friends in the group	8,1	7,7	8,4	8,9	7,5	7,7	6,6	7,6	7,6	8,0
He/she enjoys helping classmates during the activity	7,4	7,5	7,0	8,7	7,8	7,8	7,9	6,9	7,5	7,7
He/she stays calm when solving issues with others	8,0	7,0	6,3	6,1	7,4	7,7	7,2	6,8	7,0	6,8
He/she cares about classmates who are upset	3,5	4,4	3,7	4,5	4,7	4,4	4,8	4,8	4,3	4,6
He/she holds responsible a classmate when making a mistake during the activity	,5	1,2	2,7	2,4	1,5	2,1	5,8	5,2	3,2	3,1
He/she gets warned by the teacher due to inappropriate	1,1	2,0	2,0	2,8	2,3	1,1	1,3	2,1	1,7	2,1

	5-6 Age									
	Country									
	İtaly		Turkey		Spain		Lithuania		Total	
	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot	Group With Robot	Group Without Robot
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
behavior during the activity										
He/she cooperates happily with playmates	7,9	6,7	8,0	8,3	8,3	8,0	8,1	7,6	8,1	7,8
He/she shows enthusiasm towards classmates' success	9,5	6,1	7,2	8,0	7,4	7,6	7,8	6,8	7,7	7,3
He/she shares happily with the classmates/teacher the experiences he/she had during the activity	9,1	6,6	6,1	7,9	6,7	6,5	7,9	6,8	7,2	7,1
He/she gets angry when his/her suggestion about the activity is declined	2,8	1,2	2,0	2,7	1,7	1,6	2,3	3,8	2,1	2,6
He/she displays reluctance in participating in the group work	,5	1,0	2,0	2,9	1,4	1,5	1,5	1,8	1,5	2,0
He/she provides support to other children while they perform their role in the group wor	7,3	6,1	6,6	7,6	6,6	7,2	5,9	6,4	6,5	6,9
Total points average	5,8	4,7	5,7	5,9	5,6	5,3	5,6	5,3	5,7	5,4

When examining the total mean scores of 5–6-year-old children obtained from the items of the Child Observation Form by country (Table 8), we find that children in Turkey have the highest mean score in the activity without robot, while the children in Italy have the lowest mean score. In the activity with robot, we can find that children in Italy have the highest mean score, whereas the children in Spain and Lithuania have the lowest mean score. The mean score difference between the groups with robot and without robot is determined to be the highest in Italy and the lowest in Spain and Lithuania in favour of the groups with robot.

It has been concluded that all children participating in the activities with robot have mean scores above seven from the items "He/she is willing to participate in the activities, He/she does not lose interest during the activity, He/she endeavours to carry on the activity, He/she is willing to deal with the difficulty confronting during the activity, He/she becomes happy after completing the activity, He/she expresses positive feelings with a gesture, facial expression, and tone of voice when feels happy during the activity, He/she is willing to experience new activities, He/she shows willingness to complete the activity, He/she smiles often during the activity, He/she gets excited when produces new ideas or things during the activity, He/she shows courage when starting a new activity, He/she practices willingly the roles given during

the activity, He/she tries different ways to solve the issue when having difficulty during the activity, He/she is happy in group work, He/she focuses on the materials (robot) used in the activity, He/she enjoys using materials (robot) used in the activity, He/she gets excited with the material (robot) used in the activity, He/she communicates positively with the children in the group at the activity, He/she cooperates with classmates, He/she collaborates with friends in the group, He/she enjoys helping classmates during the activity, He/she stays calm when solving issues with others, He/she cooperates happily with playmates, He/she shows enthusiasm towards classmates' success, He/she shares happily with the classmates/teacher the experiences he/she had during the activity".
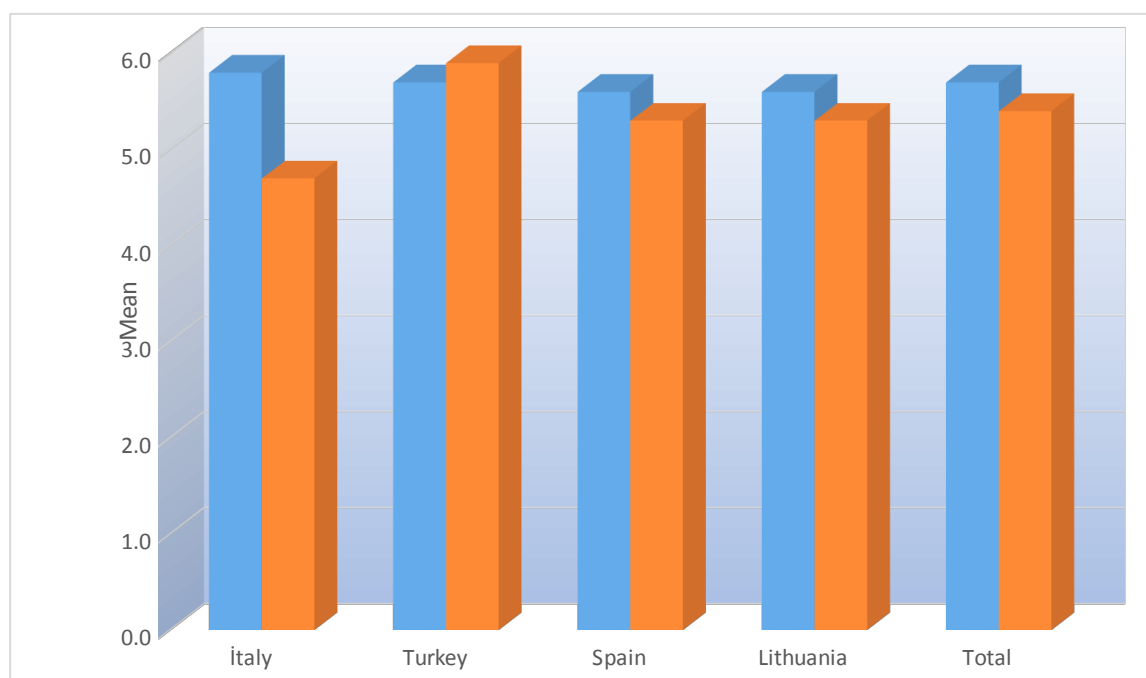
Figure 6: The graphic regarding the distribution of total mean scores obtained by the children aged 5-6 from the items of Child Observation Form by countries

Results of the second piloting phase

When examining the total scores of children in all countries (Figure 6), it has been identified that the mean score of children with robot is higher than the mean score of those without robot.

According to the observations of the teachers who participated in pilot implementation, the roles in the activities (referee, announcer, actor, coach, director) within the the PEARL Education Model were received and played with enthusiasm and joy by the children. They stated that children have acquired skills such as following directions, waiting for their turn, respecting the responsibilities and authority of others, communicating, and leading through roles.

Some teachers who participated in the second application phase commented that "children actively communicated among themselves and that the roles provided the teachers to better observe the shy children who could not express themselves." In addition, the experiences of a child diagnosed with Autism in applications with robots were shared by his teacher as follows:

"A (the child) wasn't very keen on coming to school. I thought it would be useful to have him in the classroom in project applications. When A encountered the robot, he

had an incredible interaction. He made an effort to discover the robot and asked me 'why the robot didn't listen to me?' A usually likes to play alone and has problems in performing the tasks given in group games, so he could not continue the game. When I started to implement the project activity, I saw that A participated in the activity enthusiastically and most importantly, he took the leading role in a game for the first time and stayed in the game until the end of the game. It has been an incredibly beautiful experience for me."

In addition to group interaction, the PEARL Education Model is based on peer relationships and the development of empathetic emotions. Children seek help from their peers when facing a problem in accordance with their level of development. Children may undertake different roles, cooperate in small group, learn others' point of view and develop sharing skills in their relationships with their peers. Group relationship provides not only emotional development but also cognitive development, and children internalize problem solving together. In the PEARL Education Model, educational robotics and nature activities were used to create difficulties in accordance with the developmental levels of children. The model aimed to reveal that children can develop empathic skills such as cooperation and sharing by means of these topics that are generally related to the field of cognitive development in the event of a proximal educational environment.

PEARL Project aims to develop and test an innovative, high-quality and replicable education model at the European level that is proper to develop emotional and empathetic skills of children aged 0-6 years by supporting their zone of proximal development. As seen in the research findings, when considering in terms of project goals, children aged 3-4 and 5-6 years participating in the robotic activity in a group environment have been found to have higher scores in the skills of willing to participate in the activities, getting excited to study with the robot, expressing emotions by body and verbal language, solving problems with easier and positive ways, fulfilling responsibilities, interacting with friends collaboratively than children who participated in the activity without robot.

Based on these findings in the second piloting phase, it can be concluded that the project hypothesis "Group activities enriched with robotic coding activities improve children's social skills, cooperation skills, and ability to understand and express emotions" has been confirmed.

NETWORK "NOBODY LESS"

PEARL project development has served as a local, national, European and international meeting point for teachers and research of leading experts in the psycho-pedagogical field and their educational institutions with the goal of forming a network that includes academic institutions, teacher training institutions, educational organizations, and schools to promote innovative, high-quality and inclusive educational models enhancing the impact of the early childhood education on the physical, mental, emotional and global well-being of the individuals and the group as well as a platform for promoting prosocial values in the society since the very early age stages.

In conjunction with the promotion of prosocial values in society this network is a branch of the "umbrella" international network named Nobody Less founded by ProSocial Values Erasmus+ KA 201 project that is formed by centres, NGOs, associations and educational institutions that believe in the importance of prosocial values as a fundamental pillar of the human being. Those values are the pillars that are at the base of any civil society and represent the common values that can be found throughout the world.

The International Network "Nobody Less" therefore engages educational institutions and stakeholders from all over Europe, and outside Europe, to adopt the attitude of prosociality in their daily practices as an emblem in their daily educational life. This community of prosocial values aims to bring a real change in the way children / students learn to live together to create a better world. The dissemination of prosocial values among students will help the centres to overcome situations of bullying, harassment and social exclusion and will also have an impact on a social level, paving the way for creating a more peaceful and inclusive society.

The specificity and importance of early childhood education in the development of the person is highly recognized. The first 36 months of life have been revealed as very relevant as it is the period when the brain makes the greatest number of connections (synapses). Child development consists not only of physical growth and brain development is affected, among other things, by the child's experiences. Between the age of 2 and 3 years old, milestones occur both in cognitive and motor development, as well as in communication and emotional development. For this reason, this branch dedicated to the early childhood education stage has been incorporated within the international network Nobody Less.

CONCLUSIONS

The educational change promoted by PEARL project is related to the teacher's attitude and the cognitive-emotional approach of children.

PEARL enhanced the development of a validated educational model addressed to early childhood curricula in order to follow children's interest, foster child's growth and development, "nurture their well-being and meet the unique needs and potential of each individual child, including those with special needs or in a vulnerable or disadvantaged situation" addressed to the Council Recommendation (EU) (2019/C 189/02) on High-Quality Early Childhood Education and Care Systems that recommends to work towards ensuring that early childhood education and care services are accessible, affordable and inclusive.

PEARL educational model foundations contribute to the reduction of social inequalities and the narrowing of the competence gap between children of different socio-economic backgrounds. It proposes the concrete and fundamental restructuring of school environments, a transformation that puts cooperative learning and educational robotics used in groups to facilitate interpersonal relationships and promote inclusion.

Activities designed under PEARL model pillars foster collaboration in groups, roles, build relationships and inclusive communication skills, self-reflection, empathy, creativity, self-expression, etc.

Thus, robots are used to develop inclusive pro-social skills and values, support children's full participation in activities, facilitate the adaptation of planned activities to respond to children with additional needs and enable all children to participate while learning and playing.

Observing how pupils are working in groups, allowing them space and time without interfering for children to solve problems, perform activities or tasks correctly under the teacher's eyes and allowing teachers to analyse social, emotional and existing pedagogical barriers.

All schools, teachers and headmasters have reported high levels of satisfaction and involvement. Teachers have found themselves passionate, open and eager for implementing a new pedagogical model that, by collecting well known theoretical bases, have gone beyond them, making a contribution to what already existed.

Teachers' role within the class has been transforming, moving from the ordinary interventionist teacher, trending towards a role of facilitator of emotional empathic proximal learning environments.

The project revealed educational experiences that helped children learn to empathize, learn about their rights, equality, tolerance, and diversity through social-emotional learning.

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EXTERNAL COLLABORATIONS IN THE PROJECT FULLFILMENT AND ACTIVITIES

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