CHAPTER 3. THE POTENTIAL OF EDUCATIONAL ROBOTICS FOR LEARNING ABOUT THE REFUGEE THEME: VIEWS FROM THE STUDENTS AND THE TRAINEE TEACHER

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I. Introduction

New challenges are posed to education, which require the development of skills and abilities to search, select and understand information, which is vast and varied, and sometimes contradictory. It implies, therefore, critical thinking that enables a better reading of the world and societal reality, enhancing students' digital literacy (Pereira, 2011). In this sense, as presented by Quadros-Flores et al. (2013), ICTs, in addition to involving students, can put them at the centre of learning, so that they actively participate, understand what they are learning and work collaboratively, since they favour a "constructivist approach in which collaborative learning is privileged" (Cardoso, 2013, p. 296).

This study is part of an intervention project - "Being human in the world: in a flight towards equality", developed with a 3rd grade class, within the scope of the Supervised Teaching Practice (STP) curricular unit of the Master's Degree in Pre-school Education and Primary School Teaching. It arose from the students' interest and curiosity in the current social reality of the war in Ukraine and Russia and the inequalities faced by women in Afghanistan. The educational practices were developed in four interventions, organised in learning units and were based on the Project Work methodology. Three main objectives were pursued: i) to make students aware of cultural diversity, stimulating their capacity for analysis and reflection, developing critical and reflective thinking; ii) to explore the issue of refugees, enhancing situations of empathy, in which students put themselves in the other's shoes,

ISBN: 978-84-1170-659-9

understanding their motivations and difficulties; iii) to encourage active and responsible citizenship, fostering attitudes of solidarity and intervention in the community.

It was also intended to develop knowledge, skills, attitudes and values present in the Profile of Students Leaving Compulsory Schooling (PASEO), namely critical thinking, autonomy, collaborative work, communication, valuing respect for diversity, human dignity, solidarity, rejecting discrimination (Oliveira-Martins et al., 2017). It is in this sense that the learning unit - "Everything is lost in a second and Man sees himself opening up the world" - appears. In this chapter, we will focus on one of the activities framed within this unit, which sought to develop the programming language using educational robotics. Thus, tangible object programming skills were enhanced, supported by an Action-Research Methodology with the purpose of improving practices throughout the interventions. After all, "the awareness of what a teacher actually does, and of his/her representations, is the starting point for his/her involvement as a teacher in change" (Altet, 2000, p. 33). Thus, it is necessary to recreate educational practices (Quadros-Flores & Raposo-Rivas, 2017), which necessarily require digitally competent teachers prepared for the challenges of a digital school (Graça et al., 2021).

II. The integration of educational robotics in learning

The construction of theories on education has essentially pointed towards a view of man in the world, to achieve an integrating view of it (Estrela, 2006), leading to a more humanistic education. As argued by Morin (1999), it is impossible to break down and segregate the real problems affecting society. However, it is common to observe practices where the moments dedicated to each domain are clearly distinguishable, which, according to the author, is insufficient, being a problem to be solved in education. If we aim at an education with a humanistic basis, not promoting the articulation of knowledge is, therefore, unthinkable. It is necessary, then, to look at the curricular areas in an integrating and transdisciplinary way, mobilising this knowledge for practical life. Morin (1999) indicates that the professional should focus on global problems, contextualising them in educational practice, promoting learning opportunities that enable the challenges imposed by these problems to be met. To this end, it is necessary to promote skills to act for a better world, given the growing environment of uncertainty in which students live, and help them understand others, in an education for citizenship and humanity to be able to respond to this world of permanent change (Oliveira-Martins et al., 2017). In this sense, education does not exclusively serve the curricular knowledge, but transcends to useful skills for

ISBN: 978-84-1170-659-9

life in society and values that sustain humanity. This idea is also recommended in the Decree-Law No. 240/2001 of August 30, which approves the profile of the educator and teacher. It highlights the need to use transversal knowledge in an integrated way, combining the civic and formative function of the teaching work and enhancing the integral development of children. In this sense, a transdisciplinary learning is envisaged, in which the focus is on understanding reality, admitting its complexity, and exploring themes and problems that go beyond the "traditional academic disciplines" (Beane, 2003, p. 108).

One of the fundamental pillars of the group's Educational Project is based on the idea that school should contribute to the construction of knowledge and important values for a fairer society, centred on the person and on action on the world. The development of social issues, such as refugees, occupied, in this sense, a relevant place in the project. Increasingly, students find themselves in a globalised world, confronted with issues such as war and the consequent disrespect for human rights, which they need, according to the Essential Learning (Direção-Geral da Educação, 2018), to actively recognize, being an issue that ends up causing contact between peoples, a new reality for students, it was important for them to recognize and value "the diversity of ethnicities and cultures existing in their community" (p. 5).

In this context, it is important to rethink the curriculum in the light of this Digital Society, which is characterised as complex, controversial and challenging, in which new digital skills are demanded from young people, who are considered digital natives (Prensky, 2001; Santaella, 2010). Although the motivation factor in using ICT is recognized, some teachers lack the necessary conditions to feel encouraged to use them, namely regarding the training and resources available in the school context (Quadros-Flores et al., 2013). Sometimes this is reflected as an inhibiting factor to the pedagogical integration of ICT in educational practices (Graça et al., 2021). Thus, despite recognizing their potentialities, many teachers end up demotivated by the conditions available in the educational settings where they teach. However, using ICT is not synonymous with creating a productive classroom (Cardoso, 2013), nor should these be seen as an end, but as a means to achieve a certain goal. Therefore, it is essential that the teacher integrates them pedagogically in their practice, in a constructivist way, as a cognitive tool (Jonassen, 2007), aiming at the development of students' critical and reflective thinking on the subject under study, in a perspective of research, collection, selection and analysis of information, execution of consolidation exercises or production of their creations.

ISBN: 978-84-1170-659-9

The potential is even greater for learning when these are combined with participatory methodologies, such as the Project Work methodology, where, according to Mateus (2011), learning is built around real and relevant problems, which make sense to students because they relate to the society in which they live. Because, according to the same author, Project Work allows a transdisciplinary approach to knowledge, being flexible and adjusted to the priorities of the group, it was considered appropriate to adopt this methodology. Thus, as argued by Abrantes et al. (2002), opportunities for personal and social development of students were promoted.

This pedagogical use of ICT implied that the student also developed her digital literacy, because "the Digital Competence of educators and teachers is increasingly called for the renewal of educational practices, so it is urgent to prepare future teachers for a school integrated in the digital society" (Graça et al., 2021, p. 27). Therefore, the development of the master's student's digital skills is highlighted as a relevant point to be considered for the construction of more renewed practices. In this sense, we highlight the use of Educational Robotics, through the development of programming language skills. In addition to motivating students, this resource promotes problem-solving skills and allows for the creation of environments that encourage the mobilisation of students' knowledge in different areas (Ribeiro et al., 2011). Moreover, its use, particularly the use of simulations, enhances the students' attention span, especially of those who have more difficulties, and promotes their autonomy (López-Belmonte et al., 2021). However, by promoting problem situations in which students have to resort to programming language to solve them, we will be creating opportunities that promote transversal skills that are essential in 21st century education, such as collaboration among students, since they are committed to overcoming challenges as a team, and creative thinking, which is necessary to find resolution strategies (Romero, 2016). In this specific case, a robot, the *Bee-Bot*, was used to program a route through the simple control of its arrows located on the "top" part of the robot. Thus, notions of spatial orientation were developed in the area of Mathematics (forward, backward, right turn, left turn, and pause), as well as in other areas of knowledge. In this way, students are able to see problems not as situations to be avoided, but opportunities to learn.

Finally, as mentioned by Quadros-Flores and Raposo-Rivas (2017), today, in the digital age, it is imperative to encounter new dynamics and strategies, but change with meaning is required. Now, the production of knowledge for this to occur takes place if the professional acts as an investigator, who seeks to assign meanings to what he or she is doing (Cortesão & Stoer, 1997). In

ISBN: 978-84-1170-659-9

this sense, the Action-Research Methodology is a challenge to educational professionals in order to improve educational practices (Coutinho et al., 2009), as it stimulates an analytical, critical and interventive attitude towards the problems detected, allowing for the construction of knowledge that supports "practices oriented towards social transformation" (Cortesão & Stoer, 1997, p. 27). Thus, the potential of ICT integration in the teaching and learning process leads to new challenges and opportunities for students and teachers. However, we must know how to mobilise them, according to the intended pedagogical intentionality, and combine them with more participatory methodologies that lead to the formation of critical, participatory, and autonomous students in society.

III. Research methodology and data collection techniques of the study

The Action-Research Methodology was used throughout the educational practices, since it offers an analytical, critical and interventive stance towards what is observed and the problems detected, since the researcher needs to know the context in which he or she will act. To achieve this goal, participant observation proves to be adequate (Simões & Sapeta, 2018). However, Action Research only exists when it acts to transform. Thus, as a result of this immersion in the context, relevant techniques and resources were used for data collection: i) observation guides, which could be completed through a systematic and intentional look at the reality; ii) logbooks, which were used to record the observations, accompanied by field notes, photographic and video records; iii) interviews with the cooperating teachers, supported by an interview script, with the purpose of obtaining more in-depth information about the educational context. We believe, therefore, that this is the basic pillar of the intentionality of the training of educational professionals with a view to change, transformation and renewal of educational situations. Therefore, throughout the practice, an approach to this methodology took place, since it places teacher training in constructivist models, sustained by research that is reflexive and interactive.

3.1. Participants of the study

In this study, 21 students from the 3rd grade (8-9 years old) of a school grouping in Porto participated. Curious and participatory, although not very autonomous, they showed difficulties in concentration and in working in groups, as well as heterogeneity in learning pace. The educational context in which this class was inserted had some technological limitations, namely the internet, which was unstable and conditioned the activities. In addition, they had the possibility of using a mobile projector, tablets and laptops, as

ISBN: 978-84-1170-659-9

well as robots, provided by the grouping, although their quantity did not allow for individual use. Finally, as for the dissemination of the intervention project, besides being done by the other classes of the school, family members and teaching and non-teaching staff, the 11th grade students and the Portuguese Red Cross also participated.

IV. Practical experience / Empirical experience

Throughout the SEP, the project "To be human in the world: in a flight towards equality" was built, with the objectives already mentioned above, focusing on the premise that the school contributes to the construction of knowledge and values, important for a fairer society, centred on the person, human dignity, and action on the world as a common good to be preserved. It included 4 pedagogical interventions, as shown in table 1.

Table 1.

Sessions and initiatives of the developed intervention project.

Intervention sessions	Main goals:
1st Session: "Malala: to want is to be able!"	• Learn about Malala's life; • Gain awareness that not all children live in the same circumstances.
2nd Session: "The diversity that U(n)E us: a journey from Portugal to the world"	• Recognize and value cultural and ethnic diversity: - differences between Portugal and some countries of the European Union; - shared values in the European Union;

ISBN: 978-84-1170-659-9

3rd Session: "Everything is lost in a second and Man sees himself opening up the world"	• Know the rights of children; • Recognize cases of disrespect of rights; • Understand the refugee problematic (Who are they? Where do they come from? With what motivations? What difficulties do they face? How can we help?)
4th Session: "We Are Inspiring"	• Understand the meanings of inspire; • Meet inspiring people, namely understand the work developed by the Red Cross; • To know stories of refugees; • Recognize oneself as being able to inspire to improve the world.

Source: own elaboration.

In these intervention sessions digital technologies were integrated into active and participatory learning methodologies, according to the intended pedagogical intentionality. However, in this article, we will only focus on one of the lessons developed in the 3rd session, in which educational robotics was used.

The learning unit had the problem question "What do we face when we lose some rights?". It aimed to raise students' awareness about Children's Rights, showing some cases of disrespect for them. It included 3 lessons; however, we will focus on the lesson, also accompanied by other digital technologies, in which the use of educational robotics was privileged (Table 2). The presented drawing allows us to contextualise the emergence of the activity and reveals how the contents can be approached in a transdisciplinary way, in a coherent and non-segregating process, to develop a pertinent theme - refugees.

ISBN: 978-84-1170-659-9

Table 2.

3rd lesson of the learning unit - use of educational robotics.

Design of the learning environment	Goals	Resources
• Prior knowledge survey: distinction between migrant and refugee; • Dialogue on cases of disrespect of fundamental rights and analysis, with the game "Was I forced?", of situations potentially promoting forced migration; • Reading and analyzing the literary work A Long Journey by Daniel Hernandez Chambers (2018) and identifying the difficulties faced by refugees; • Location on the world map of countries in which some refugees originate, with determination, conversion and comparison of distances.	• Develop critical thinking, autonomy, collaborative work, communication, adoption of an interventional and solidary posture; • Recognize their rights and cases of disrespect for them; • Understand and distinguish the definitions of migrant and refugee; • Recognize causes and difficulties associated with forced migration; • Relate the migration of animals to the migration of human beings; • Listening to read, reading and interpreting a literary work; • Recognize points on the globe through ICT; • Collect, read, and analyse numerical data (understanding the concepts of maximum, minimum, and range); • Recognize the meter and the kilometer as units of measurement and perform conversions.	• Computer; • Projector; • Speakers; • Image "I had to give up this right"; • Digital Platform Wordwall: https://wordwall.net/pt/resource/25012480/fui-for%c3%a7ado • Literary work *A long journey* by Daniel H. Chambers (2018) • Guide for interpreting the work Analysis script "How long is the journey?" • Digital Platform *GoogleEarth*.
• Simulation of the route of a refugee from one of the previously mentioned countries to Portugal, using the programming language with a *Bee-Bot*: - each student receives a sheet for recording the different schedules performed; - in a small group, the student discusses the programming he will do to the *Bee-Bot* on the grid mat;	• Develop critical thinking, autonomy, collaborative work, communication, adoption of an interventive and solidary posture; • Orient themselves in space, describing positions and routes/itineraries; •Recognize the potential of robotics (the Bee-Bot); Understand and mobilize the programming language for the realization of a route.	• *Bee-Bot* • Checkered carpet with obstacles/difficulties refugees face in reaching their destination • Schedules log sheet

Source: own elaboration.

ISBN: 978-84-1170-659-9

Throughout the learning unit, students recognized the importance of health and family rights, and when discussing cases where rights were not guaranteed, students shared their prior knowledge of the words "migrant" and "refugee" using the digital platform *Wordwall*. Its use, as a cognitive tool (Jonassen, 2007), aimed to create a map of ideas about the theme, thus enhancing the students' ideas and leading to greater motivation. Starting from this analysis of initial ideas, we proceeded to read and analyse the work *A Long Journey* by Daniel Hernandez Chambers (2018), accompanied by interpretation questions, with the aim of recognizing war as a reason for forced migration, understanding the difficulties faced by refugees on the journey and the conditions under which they arrived in the destination country. Thus, on the one hand, the development of reading and interpretation skills was intended, within the scope of Portuguese, in the domains of Literacy Education and Reading. On the other hand, the study of the environment, with the identification of a social problem and the recognition of cases of disrespect for the fundamental rights of human beings, permanently present in the exploration of the problem, and which were articulated with the area of Mathematics.

Building on the exploration of the work, the students were asked, "If a refugee were to come here, would they face such a long journey? How far away from us will the countries from which the refugees come be?". To try to answer the questions, at an early stage, the students made estimates. Then, they confronted their idea with the measurement of the distances between the municipality where the school was located and some of the countries from which more refugees were arriving, through *GoogleEarth*, since this digital platform allowed the visualisation of a three-dimensional image of the globe, which allowed the location of these countries and the subsequent determination of their distance to Portugal. In this sense, and as mentioned in the Mathematics AE, students should be able to establish connections between the same mathematical ideas, namely using technology, reading, interpreting and discussing data, such as measures or even reading and interpreting maps and aerial views (Direção-Geral da Educação, 2021). Thus, it was proposed to students the determination of these distances using the platform tools, to, at a later stage, perform conversions between units of measurement, developing, also, skills in reading numbers.

Therefore, for a better understanding of the subject under study and with the purpose of developing mathematical skills of spatial orientation and programming language of tangible objects, an activity was built using educational robotics, in which students were challenged through a *Bee-Bot* available at the institution to simulate the journeys of refugees. As Delors et

ISBN: 978-84-1170-659-9

al. (1996) state, technology, when well used, is a motivational factor for the student to develop learning. In particular, the Initiation to Programming is important, as referred to by the Directorate General of Education (2016), so that, from an early age, students "create habits of using technologies in an appropriate and constructive way" (p. 3). Thus, in small groups, the students, using the programming language, programmed the robot to perform a route, avoiding obstacles and simulating the refugees' journey from their country of origin to Portugal. While one group programmed the robot on the squared mat, built by the trainee teacher, the others had to record that same programming in the guide script that included a grid for the students to fill in the starting and ending points and the obstacles. In other words, all the students recorded the program carried out by each of the groups. Thus, the collaboration of the student was required to solve a problem, a method that, according to Lebrun (2002), favours learning and for which technologies can be put to use.

IV. Results

Next, we will focus on the effects of the use of educational robotics from two perspectives: the students' perspective, using observation notes (NO) and students' interventions throughout the activity (A); and the trainee teacher's perspective, through her observation notes (NO) and her reflective narrative (NR).

4.1. Effects of using educational robotics from the students' point of view

The educational robotics activity proved to be, from the beginning, motivating and stimulating for students, since its use was not common in the classroom, which aroused interest and curiosity. Moreover, the very handling of the robot by the students also increased their enthusiasm and willingness to explore, which was noticeable in the students' interventions: *"Shall we all move?"* (A2) or *"I want to try it!"* (A1). In addition to the enthusiasm visible on the students' faces, the activity gained even more relevance because it offered the possibility of the students being the builders of their own knowledge (Moran, 2018), which contributed to the promotion of the development of essential skills, such as persistence, autonomy, and concentration, which were previously presented as difficulties evidenced by the class.

The students were attentive, involved and, with interest in listening to the indications, they strove to understand and successfully perform the proposed challenges, in a spirit of collaboration in which critical thinking (Oliveira-

ISBN: 978-84-1170-659-9

Martins, et al., 2017) was stimulated in order to find solutions to the problem at hand, the route of the refugee (Figure 1).

Figure 1.

Students' programming language development through educational robotics.

Source: own elaboration.

By observing the images, the students mobilised in their speech the lessons learned about the problem, namely the difficulties that each image represented. A moment was created in which everyone was prepared to put themselves in the other's place, a practice of empathy promoted throughout the project, and which culminated with its dissemination. Fingers crossed to cross their fingers or hands together, raising them to the sky, were gestures shared by some students during the activity, which showed their involvement and desire to see their work successfully completed. One of the aspects observed was that students, including those who were not in the small group manipulating the *Bee-Bot* at the moment, *"clapped their hands after the completion of a route, which showed the team spirit and collaboration, and not competition, that was being built"* (NO). The happiness for understanding and overcoming the challenges and their inherent gestures should also be mentioned, since gestures also provide us with great information about

ISBN: 978-84-1170-659-9

students' learning, as Malaguzzi argues, when he states that children have 100 languages, multiple ways of communicating, and speech is as informative as gestures or movements (Lino, 2013). Therefore, it is essential that the professional recognizes these multiple languages and gives children the opportunity to express themselves (Souza & Veronesi, 2019).

However, the emerging problems arising from the implementation of the activity should not be ignored, since their analysis is essential to give meaning to the practices and seek to improve them. Despite the involvement and the spirit of "positive confusion" noticed, some difficulties were detected on the part of the students, namely difficulties in the capacity of abstraction, not being able to schematize in the script the path that was being executed by the group with the *Bee-Bot*, namely in the use of the programming language itself with arrows. Despite the fact that they were attending Initiation to Programming, where they explored these practices and concepts, some of them still showed doubts in using the terms "a quarter turn left/right" and, therefore, mathematical knowledge of location and orientation in space, present in Mathematics AEs (Direção-Geral da Educação, 2021), essential for programming. Thus, each group's time was extended, and the others could not follow the work of their colleagues, filling out the record sheet. Therefore, it was necessary to extend the activity, making adaptations. Based on the assumption that everyone has the right to learn, although with different learning paces, it was our intention that the class would be following all the steps of the activity, which was not happening. It was essential, therefore, to help them understand these aspects. Thus, it was decided to stop and, as a class group, discuss how they should perform the programming, challenging them, with examples, to translate the movements that the arrows represented, in which the student had the opportunity to take an active posture. Only when it was verified that everyone had understood, the programming of the courses proceeded.

This evolution of the students' understanding of the programming language was reflected in the following moments of the class, in some of the students who had not managed to understand and assimilate the programming language. We highlight the example of student A1, who, like her classmates, was determined to answer the challenges autonomously. Student S., concentrated and in a good mood, stood up and positioned herself according to the *Bee-Bot's* orientation in order to program the movements and register the programming language with arrows: "*The robot is like this, I have to stay like this [positioning himself with the same orientation as the robot]. Now, if he has to go over there [pointing to the left], I have to go a quarter turn to the...left! The arrow is like this, then. [Turns to the record sheet to draw a left-*

ISBN: 978-84-1170-659-9

facing arrow]" (NO). The point to note in this observation is that, without cues, *"the student was able, by finding her own strategy, to understand the programming and movements and respond to the challenges"* (NO). It was also observed, in general in the class, progress in the ability to program the next morning, since the students showed they knew the steps of the process and were able to correct themselves and correct the other, arguing the reason for a certain thought when programming and, thus, avoiding mistakes. This ability to share and collaborate meets, as Moran (2018) argues, active learning, in which the student is at the centre of the learning, as intended: *"One group agreed that everyone would take turns programming the robot's movements. A2, announced that he was going to program the Bee-Bot to move forward three squares. His friend A7., from the same group, called his attention before the robot was programmed, arguing that it should only move forward two squares. Otherwise, the Bee-Bot would run into an obstacle. The group agreed and R. recounted the squares, recognizing that he had made a mistake in counting."* (NO). The students understood what they were doing, and the errors that appeared were the result of small distractions. The adult intervention was less and less necessary because the students were able to collaborate, creating a climate of sharing and learning among them. Thus, it was observed the impact that the problematization of situations causes in students, who engage in understanding and solving them, developing a critical sense that allows them to build knowledge (Freire, 2006).

4.2. Effects of using educational robotics from the trainee teacher's point of view

The reflection carried out by the trainee teacher, central to the training process that highlights the awareness of herself and her limits in the context of pedagogical and technological knowledge, can be divided into three moments: lesson planning, reflection on action in the face of emerging problems, and post-action.

In this sense, knowing the potential of technology, particularly educational robotics, implementing an activity in which the trainee teacher would use it was a challenge, since she did not know many digital tools, had never planned an activity of this type and, furthermore, when observing the educational context, she noticed some inhibition in the use of ICT by the teacher, which was conditioned by the context, which had an unstable internet network. These initial difficulties were highlighted in the reflective narrative of the trainee teacher but were not inhibiting reasons for the construction of innovative practices: *"In addition to the fact that there were*

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not enough tablets to allow individual use, Internet access had many faults. If, sometimes, with only one device connected to the network, there were connection cuts, it was certain that, by connecting several devices, the internet failed in all. However, it was argued that these conditions should not inhibit the use of ICT, and that it was necessary to seek solutions that would make it viable. Trying to use them pedagogically and believing in their potential contributed to the fact that, with the support of the institutional supervisor, as a future professional, I learned about new platforms and gained skill in using them. That said, in the presented activity, we intended to involve ICT, putting the student at the centre of learning and enhancing sharing in the promotion of collaborative work." (NR).

The trainee teacher overcame the fear of the unknown, sought to build knowledge about the use of the resource in students' learning, finding solutions that allowed the educational practice to be carried out, and did not allow these aspects to be inhibiting factors of the pedagogical integration of ICT in educational practices (Graça et al., 2021). In addition, we did not intend to conceive the use of technology as an end in itself, but as a constructivist cognitive tool, framed in contextualised activities, articulated with the areas of knowledge and integrated within the scope of the project that was being developed.

Time management was also an important point that the trainee teacher mentioned in her reflection, since she chose not to comply with the planning time, which was previously defined, for the sake of student learning and the difficulties that were being noticed, because, as Cardoso (2013) states, a proactive teacher "never gives up on making the student understand and reach the objectives" and "her mission will not stop until she finds a way, possibly differentiated, for each student to grasp the lesson" (p. 65). It was also one of the aspects reflected in his NR: *"Reflecting on the observations made in the action, it is important to highlight the relevant role assumed by the flexible nature of the implementation of the planning, particularly in terms of time management. I planned 50 minutes for the programming activity with the Bee-Bot. Analysing the observation notes, considering what I knew about the class, namely the pace of work, and taking into account the difficulties detected in the students, one can understand that this prediction was, from the start, a mistake. As it turned out, it was necessary to continue the activity in the afternoon and the next morning. This continuity was given in order to guarantee the same opportunities to all students, that is, so that everyone could manipulate the robot and program its path, under the same conditions. It should be understood, however, that the problem does not lie in the delay,*

ISBN: 978-84-1170-659-9

but in the reasons that caused it. Reflecting on them is important to detect the need to make adjustments and improve the teacher's practices." (NR).

With the necessary support, the difficulties were prevented from becoming blockages for the students (Perraudeau, 2006). As the group indicated the next step that the Bee-Bot would do, they were asked to select the arrow that should be placed on the board present in the script provided, recording the programming and supporting the students who, with more difficulties, could not follow the rhythm with which the indications appeared. Thus, it was ensured that the class recorded all the routes presented and discussed during the class.

Finally, given that a teacher must assume his or her responsibilities in the students' results and reflect on the appropriateness of the strategies he or she used and how he or she can help them recover (Cardoso, 2013), it should be noted that, although the activity had allowed for the development of learning in students, as well as a growing motivation in the use of educational robotics, the implementation of another strategy would have been beneficial for the implementation of the activities, envisaging a possible alternative: *"It would have been more advantageous to provide a moment of dialogue, in which programming knowledge was previously developed, before moving on to the application with the Bee-Bot. Certainly, this strategy would have made the moment more meaningful from the beginning, avoiding some of the problems mentioned. Despite the emerging problems, to which we tried to respond, reflecting after the action, we made a positive balance, considering the favourable environment for learning that I managed to create and the progress that the students showed. The motivation caused by the resource, a potentiality shared by ICT, was verified, putting the students in front of new challenges."* (NR).

Recognizing weaknesses, potentialities, envisioning new ways of learning and teaching is important for teachers' professional development, since professional growth, as Graça et al. (2019) point out, is materialised by experiences in real contexts, in a joint and interactive dialogue with the agents involved, with a view to renewing educational practices.

V. Conclusions

Pedagogical practice "is the opportunity to learn to transform disciplinary knowledge into professional knowledge capable of grounding and guiding the daily teaching action" (Formosinho & Niza, 2009, p. 130). It is important, therefore, to highlight the learnings built throughout the educational practice

ISBN: 978-84-1170-659-9

presented. Integrating educational robotics as a cognitive tool that aims to develop students' complex thinking (Jonassen, 2007) in the project allowed the association of abstract thoughts related to programming with something tangible and with a purpose, enabling students to understand the usefulness of technology (Direção-Geral da Educação, 2016).

Moreover, it should be noted that one of the main difficulties recognized in children was related to the ability to maintain concentration and perform activities independently. In this sense, the use of educational robotics provided an answer, as it was a motivating and appealing strategy. On the one hand, it promoted involvement and enthusiasm since students remained interested and engaged in performing the programming in a relaxed and fun environment. On the other hand, their persistence in solving the problem, even with the difficulties already mentioned, did not make them give up until they overcame the challenge. This, because they were intrinsically determined to succeed, and not because they felt external and oppressive pressures, wanting to learn how to accomplish the various possible routes. Moreover, there was room for error since their mistakes were not pointed out with judgement. They recognized them themselves, could observe their consequences through the *Bee-Bot's* movements, and in the next moment discuss and try again, developing the expected skills (collaboration, communication, abstraction, spatial orientation, use of the programming language), in an active and innovative learning process.

It also enhanced communication and collaboration among children since they had difficulties in managing behaviours and distributing tasks when performing collaborative work dynamics. Within the small group, the students, without directions, discussed and agreed on the distribution of tasks, organising themselves in order to give opportunity to all elements to actively participate and manipulate the *Bee-Bot*. The spirit of mutual help, enhanced by the dynamics created with the use of this digital resource, remained thus evident, being a reason for satisfaction.

Finally, I would like to highlight the importance of the Action-Research Methodology, which conducts a continuous process of observation, planning, action, and reflection, practises necessary for the constant search for progress and answers to the problems faced. Through it, it was possible to transform insecurities and doubts into achievements and learning. The factors that could inhibit the use of digital technologies in the classroom became aspects that the trainee teacher saw as potentialities for that group of children, as she tried to be a "reflective and critical professional who accesses the profession to reconstruct herself" (Graça et al., 2019, p. 132).

ISBN: 978-84-1170-659-9

In that sense, in future educational practices, it would be interesting, on the one hand, to make the changes identified as pertinent during the after-action reflection and, on the other hand, to understand what the potentialities of the frequent use of this type of resources by the students are in their learning and in their own behaviour. To what extent were their potentialities and the achievements that were recognized promoted by the novelty factor? What other observations and progress would be recognized as the integration of educational robotics in the classroom became more common? These are questions that future reflective practices might answer.

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