



Contributions of Robotics to Inclusive Education

Silvino Antonio Castañeda Rincón and
Richard de Jesús Gil Herrera

EasyChair preprints are intended for rapid dissemination of research results and are integrated with the rest of EasyChair.

November 7, 2021

Contributions of the Robotics to the Inclusive Education

Silvino Antonio Castañeda Rincón, UNADE, Colombia, antoniocas7776@gmail.com

Richard de Jesús Gil Herrera, UNIR, España; richard.dejesus@unir.net

Abstract

The Educational robotics (ER) is entering to the schools gradually generating a positive attitude in the students because of active methodologies accompanied by recreational as well as functional activities and dynamic practices. Welcoming to the entire population in its diversity is the objective of the public and private organizations which assist the education of the population. This study makes an analysis of the research made the recent years related to robotics and educational inclusion, following the heuristic and hermeneutic methodology, to establish some basis to make an approximation of the contributions that robotics can offer to the educational inclusion. The results show a growing use of ER as a learning tool that arouses the interest and enriches the training, creativity, social, and communicative skills. As a conclusion of this study, the robotics strengthens two essential components in the meaningful learning, by one side, the emotional profile, encouraging the student to set goals, and by the other hand, the cognitive one, that carries to the acquisition of competences for an eventual and inclusive professional life.

Keywords: (Educational robotics; Inclusion; Inclusive education)

1. INTRODUCTION

Approximately sixty years ago, that robotics was associated with education through Paper's studies and since there, it has advanced by giving different names to this union such as pedagogical robotics, didactic robotics or educational robotics, always aimed in generating learning environments where the Teaching philosophy is that the student can seek and find solutions to a certain problem.

Giving to the student the basic elements and then allowing them to solve a problem with these bases by manipulating mechanical, electrical, an electronic element, programming their control, taking care of an aesthetic, and gradually increasing its complexity while maintaining the level of motivation, allows it to go growing in knowledge and degree of deepening of different areas and understanding the transversality of knowledge as well as the solutions in the real world.

Today, the robotics is used since preschool to university levels to reinforce diverse knowledge areas with exceptional results. It is important to remember that its use is not limited to reinforcing the contents of some areas, but ER also enhances the own competences of the new methodologies such as collaborative work and decision-making.

Laws are being established so that the ministries of education advance in programs which admit students without any race, genre, color, and inclusive with some special dysfunctions or educative needs, in the classrooms level, making of the education the main institution that tends to being inclusive.

Some studies related to the educational inclusion and the influence that educational robotics has had in this field have been carried out worldwide, finding successful experiences. This study has as the general objective: To establish the relationship of key success factors (SKF) to achieve inclusion based on basic and intermediate

level training using robotics. As specific objectives it is aimed to: -Inquire into the status in the technical literature about robotics like training mechanism in the elementary and secondary education, - Review the technical literature about inclusion and -Establish any semantic relationship that links the educational robotics and the inclusion, based on the recent published studies.

2. THEORETICAL FRAMEWORK

A chronological account is made of the advances presented in ER, inclusion, and ER as a tool for inclusion.

2.1 *Advances in Educational Robotics*

There are many researchers who have contributed to the great advances that have been presented on this subject, among them stand out:

Seymour Papert in the 60's, begins his work about artificial intelligence from the institute of technology (MIT) and created the first electronic device that responds to a programming language called "Logo", inspired by Piaget's theory of "constructivism", and that in 1980 would be giving out by the world in his book "Mindstorms. Papert had understood that computers were a new way to educate children and based on these backgrounds he developed his theory with the name "constructionism". The complement to this theory begins to develop with works and research that use robotics as an element to support of the learning, giving the name of Educational or Pedagogical Robotics. Next to this new teaching- learning proposal, some companies launch kits of assembly materials to dabble in the world of robotics in the classrooms in an easier and more adaptable way.

Giving a pedagogical approach to robotics based on the theories of Piaget's constructivism and Papert's constructionism has been the axis of inspiration for many investigations carried out since 2000: Bers and Urrea, (2000), Xudong and Weinbeg, (2003), Pérez (2004), Sánchez (2004), Mataric (2004), Acuña (2006), Ruiz (2007), Andrade, (2007), Virnes, (2008), Pinto, Barrera and Pérez, (2010), Gaudiello & Zibetti, (2013), (Ramírez PA, 2013) and many other referenced studies.

This advance has led to robotics in several countries to dabble in the curriculum of educational institutions, transforming methodologies as well as didactics, contributing to the meaningful learnings of a generation that demands changes and improvements in their training.

Among the most representative authors for their studies in recent years about ER are the following: the expert Katia Pittí, in her research, she states that this branch generates collaborative environments that stimulate the 21st century skills: Collaboration, Creativity, Communication, and Criticality (Pittí, 2014). Likewise, in (Márquez D & Ruiz F, 2014) ER motivates and enhances creativity by combining several areas that make the students grow in their training and consolidate their knowledge. In addition, Montés Sánchez (2017), develops some positive contributions in different contexts related to the education that reaffirms the potential of this resource.

In the other hand, Saira Anwar, Nicholas Alexander Bascou, Muhsin Menekse in their study (2019), they classify 147 investigations related to Educational Robotics between 2000 and 2018 in five themes: a) the

student learning skills; b) transference amongst the students, c) creativity and motivation, d) increased participation, and e) professional development of teachers.

In María González, Yadira Flores and Claudia Muñoz (2021), analyze the panorama of educational robotics in favor of STEAM learning. This research takes 105 studies published between 2005 - 2019 and classifies them into three themes: Educational Robotics, robotics, STEAM-STEM skills, and computational thinking.

2.2 *Advances in Educational Inclusion*

Immersed in a tendentiously exclusive society, since the beginnings of humanity, highlighting the differences by gender, race, color, socioeconomic strata, and others. Society has been slowly accepting inclusion processes, particularly in the field of education. In the 19th century, great advances were made with the French Revolution: a minimum labor market for blind and non-listeners people, and the possibility was opened for women to enter schools to be trained to read and write, situations that would mark a great progress in inclusion, due to gender differences.

Offering conducive learning spaces that involve the entire population is an obligation and a challenge for today's society, improving their quality of life. A high percentage of the world population presents barriers in their learning due to different factors, whether they are sensory, physical, emotional, and intellectual, aspects which generate the need to appeal to an education under appropriate learning methodologies and strategies.

The path taken in inclusion is the result of projects by international and national organizations, groups of teachers, parents, and independent people who have been concerned about the education of the excluded population throughout the world because of different circumstances (Sarto Martín, 2009).

The World Bank, the United Nations Development Program, and UNICEF in 1990 assemble the world conference on "Education for All" in Jomtien Thailand, where its main objective was to meet the basic learning needs of all. Based on poverty, inequality, exclusion, and lack of training. In fact, inequality in the education of women and girls was taken as a special case. (Ferrer, 2008).

UNESCO interested in this issue and in looking for equal rights for all the society in 1982 conceives the idea of organizing a world conference about special educational needs held in Spain in 1994 (Blanco & Duk, 2019). This document sets the bases and guidelines for the great world change respected to the education of a large part of our society that has special educational needs.

Based on this declaration and under the slogan "Education for All (EFA Education for All,) 1994", the countries belonged to the UNESCO and the society in general, have adopted inclusive policies that cover the entire population in an exclusion situation in order to improve the quality of their education.

In 1996, the Amman International Consultative Forum on Education for All was organized to assess the progress made since the Jomtien, Thailand conference. In 2000, the World Forum on Education for All was held in Dakar, Senegal, in which emphasizes in the needs of poor children, in the rural population, ethnic minorities, victims of conflicts, those affected by AIDS, those who suffer hungry, and children with health problems.

In 2006 the Convention on the Rights of People with disabilities approved by the UN was carried out with the aim of looking for the recognition of general society for this sector, which is ten percent of the world population approximately. In the Article 24, which is related to education, establishes that the participating countries must look for an inclusive education for all the students at levels since pre-school to vocational training, guaranteeing a comprehensive educational environment under equal conditions for all (UN, 2006). This convention sets the parameters to consider inclusive education as a right and not as a simple principle.

In 2008 the International Conference on Inclusive Education is organized by UNESCO with the slogan: "Inclusive education: the way to the future". Thus, the passage from exclusion to inclusion is considered through several stages, being the inclusive education as the last one.

Carlos Parra Dussan (2019), cites: "Inclusive education implies that all children in a given community learn together, regardless of their personal, social or cultural conditions, including those who have a disability. It is a school that does not require entry requirements or selection or discrimination mechanisms of any kind to make the rights to education, equal opportunities, and effective participation. In the inclusive school, all students benefit from an adapted teaching to their needs and not only those with special educational needs".

In 2015, the United Nations Organization with its 193 participating States approved the 2030 agenda for Sustainable Development, this has 17 objectives which will guide the work of the member nations until 2030. The fourth objective (SDG 4) is aimed to raise the need to guarantee inclusive and equitable quality education, emphasizing in ensuring to the vulnerable groups and people with disabilities. (Román, 2017).

In 2017, Europe adopts the European pillar of social rights, which is mainly focused to the right of inclusive education, inclusive training and learning which generate labor competences (Gallardo, 2018).

The path towards the inclusion in Latin America and the Caribbean has been led by UNESCO, having as a guideline the Salamanca Agenda (1994), with the clear objective of including in the education plans of each country, the inclusive schools which attend to the diversity of the population which need of them for their quality formation.

In 2017, with the declaration of Buenos Aires, Latin America, and the Caribbean set guidelines as educational priorities for 2030 where stands out the importance of ensuring for a quality inclusive education. (Orealc / Unesco, 2017).

Now this issue seen since the perspective of teachers as a fundamental piece in the process generates fears and doubts (Ainscow, 2001) and comes accompanied by many questions which are not clear at the time of establishing the laws that guarantee equity and that continue generating doubts as well as discrepancies between them. Among others, stand out: lack of training necessary to attend to the diversity of the population with special educational needs (SEN), the lack of resources destined exclusively for this purpose, the time necessary to monitor these cases, the ignorance of the problems within of the family nuclei, the attitude of the students towards inclusion, among others, (Sinisi, 2010) which make that inclusion appear in educational institutions at a slow step.

2.3 Educational Robotics as a support for the Inclusion

The ER in the last decade has entered in the classrooms, transforming methodologies and strategies for many teachers and in different fields and opening other possibilities and opportunities to reach students under an active approach for the new generations. It is related to science, technology, engineering, mathematics, and physics mainly (Williams, 2007), but it also offers many more lines of action to work on other aspects related to learning such as: motivation, interest and cooperation (Daniela L. &, 2016).

Interested in working for the great goal proposed by UNESCO on education for all, efforts have been made to cover the population with educational needs and one of the most outstanding researchers on the subject is Cristina Conchinha who, together with several researchers, has designed workshops and researches where: they clarify the terms on special education, train teachers about the use of educational robotics in children with Special Educational Needs (SNE) and apply different workshops for special cases,(Conchinha, Osório, & de Freitas, 2015), (Conchinha CE, 2016).

Starting on the Salamanca Declaration, the educational inclusion incorporates both students with special needs, as well as those of different cultures, socioeconomic states including different genders, Linda Daniela and Miltiadis D. Lytras in one of their investigations make an analysis since this approach to establish 4 dimensions: -Special Needs, -Socioeconomic Status, -Cultural Diversity, -Gender Balance. (Daniela L. &, 2019). Stances that analyze a reality that is lived in all levels and cultures and, is that, in a classroom finding students with varied needs.

3. METHODOLOGY

The research is of a documentary style, it reviews the studies related to the topics which are represented by the next graphs. (Figure 1).

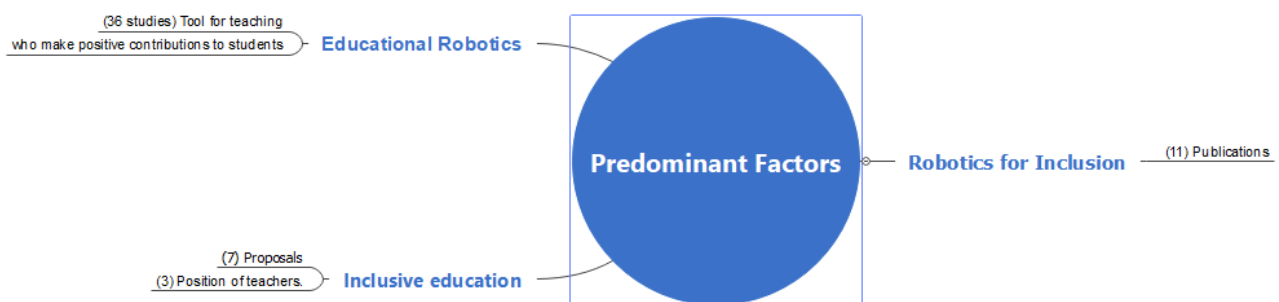


Figure 1-Study topics.

The documentary search is carried out through different academic databases such as: Google Academic, Microsoft Academic, LA Reference, Dialnet, Redalyc, SciELO, ACM Digital Library, IEEE Xplore, ASEE Annual Conference and Exposition, among other.

As a methodology, the phases to elaborate a state of the art proposed in (Londoño , Maldonado & Calderón, 2014) were followed, where the heuristic phase refers to the search and investigation in different sources to find the necessary information for the proposed research. It is divided into six steps: 1. Preparation: or selection of the topic or topics to be investigated; 2. Exploration: Specify the information that is required; 3. Description: theoretical references by subject, year and methodologies if they are necessary; 4. Formulation: Indicators starting on the information found; 5. Collection: Compile the relevant information by topic; 6. Selection: Organize the material, determine if it is necessary. The Hermeneutics phase, which refers to the ability to explain and interpret relationships between a fact and a context and to classify it. It is divided into the three following steps: 1. Interpretation: analysis of the documents by areas forming thematic nuclei; 2. Theoretical Construction: Review of the interpretation of the thematic nuclei to conclude the current state of the subject; and 3. Publication: Make the results be known by the scientific community (Figure 2).

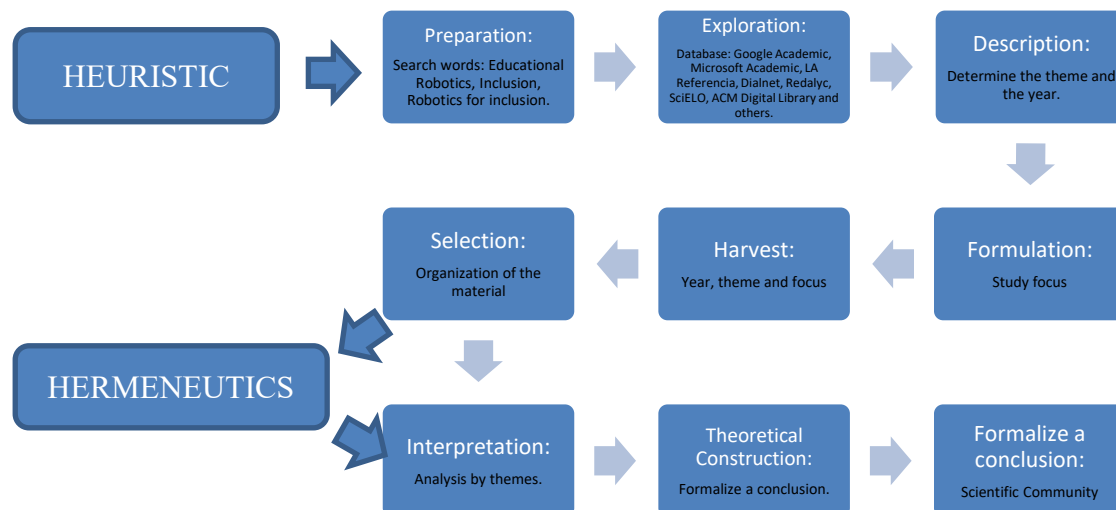


Figure 2 - Phases of the Methodology.

Three central themes in question will be analyzed:

For the topic of **educational robotics**, 36 studies were selected that relate robotics to learning processes and its positive contribution in classrooms in the last ten years. In the interpretation stage, 6 groups are established according to the predominant approaches: **interest, motivation, social skills, creativity, problem solving, and significant learning.**

Nine of the analyzed studies relate educational robotics with (1) **the interest**, by developing practical works with assembly elements, whether they are kits on the market or designed in the classrooms. The authors relate the interest as the ability to capture the student's attention, attract him/her, surprise him/her, cheer him/her up, achieve a favorable attitude, a willingness to carry out an activity (Salamanca, Lombana, & Holguín, 2010), (Moreno, and others, 2012), (Rodríguez, Bravo, & Vargas, 2013), (Román Graván, Hervás Gómez, & Guisado Lizar, 2017), (D'Abreu, 2017), (García, Duron, González, Aguirre, & Ramos, 2017), (Bustamante, 2018), (Guimarães, Rubio-Tamayo, Bayan Henrique, & Passerino, 2018), (Sánchez, 2019).

By the other hand, are eight studies that relate educational robotics with (2) **motivation**, generating initiative, curiosity, encouraging and paying skills to develop an activity that generates autonomy by its practical development through trial error practice and that implicitly allows them to solve a problem based on levels of complexity that the student himself plans (Castro Rojas & Acuña Zuñiga, 2012), (Ocaña Rebollo, 2012), (García & Reyes, 2012), (Márquez D & Ruiz F, 2014), (Ghitis & Vásquez, 2014) (Marisol, Claudia , & Monica, 2015), (García, Duron, González, Aguirre, & Ramos, 2017), (Sánchez, 2019).

Also, the Educational robotics related to the development of the (3) **social competences** is analyzed in fourteen studies where the authors take them as social, soft or non-cognitive skills that help to manage emotions at different times, whether they are positive or negative to interact with other people, how they affect the focus of their learning and strengthen teamwork (Chavarría & Saldaño, 2010), (González, 2011), (Lombana NB, 2014), (Marisol, Claudia, & Monica, 2015), (Mora Isidro & Prada Castro, 2016), (Eguchi, 2016), (da Silva Filgueira & González González, 2017), (Almeida & Canarias, 2017), (García, Duron, González, Aguirre, & Ramos, 2017), (Muñoz-Repiso & González, 2019), (Vargas, and others, 2019), (Sánchez, 2019), (Caballero González & García-Valcárcel Muñoz-Repiso, 2020), (Romero, 2020).

On the other hand, there are seven studies that relate educational robotics with (4) **creativity** as a positive factor in learning, and they focus on the imaginative quality, the fluidity of ideas so that the student looks for the best solution through trial and error that stimulates confidence (Márquez D & Ruiz F, 2014), (Lombana NB, 2014), (Marisol, Claudia, & Monica, 2015), (Nemiro, Larriva, & Jawaharlal, 2017), (Hervás-Gómez, Ballesteros-Regaña, & Corujo-Vélez, 2018), (Bustamante, 2018), (Guimarães, Rubio-Tamayo, Bayan Henrique, & Passerino, 2018).

Regarding the studies that relate educational robotics with (5) **problem solving**, there are six of them which determine that the student starts from a problem situation in his context, processes the information looking for a connection with their pre-knowledge, makes a mental or graphic representation and identifies the most appropriate solution (Chavarría & Saldaño, 2010), (Marisol, Claudia, & Monica, 2015), (Nabeel, and others, 2017), (Hervás-Gómez, Ballesteros-Regaña, & Corujo-Vélez, 2018), (Zapata, Costa, Delgado, & Torres, 2018), (Ramírez, Quintero, & Builes, 2021).

Likewise, in the Studies that relate educational robotics with (6) **significant learning**, they are based on practical work and its contributions to the understanding and contextualization of learning that leads them to possible solutions that make their progress significant when responding to particular needs (Fiorio, and others, 2014), (Patiño, Diego, Rodilla, & Conde, 2014), (Ghitis & Vásquez, 2014), (García, Duron, González, Aguirre, & Ramos, 2017), (Nabeel, and others, 2017), (Muñoz-Repiso & González, 2019), (Sánchez, 2019), (Vargas, and others, 2019).

For the topic about (7) **inclusive education**, ten articles were selected, from conferences, conventions, and studies whose main theme is educational inclusion in the last five years seen since the normative part and since the perspective of teachers.

Seven articles were found which indicate the status of the technical literature about inclusion at the basic and secondary education level. It starts from the principle of giving quality education to the diversity of students that can be presented in the classroom where quality and equity are mixed to reach to the real inclusion with

manifestations in moods, participation and desire to attend to the classes (Guasp, Ramón, & De la Iglesia Mayol, 2016), (García Valiente, 2017), (Sarrionandia, 2017), (Valbuena, 2017), (del Río, García-Ruiz, & Rodríguez, 2018), (Blanco & Duk, 2019), (Mitchell, 2020).

Three recent studies on the position of teachers regarding educational inclusion are analyzed too. Very positive opinions appear in institutions where inclusive education for all is drawn from their vision and institutional mission, reinforced from the educational plan, but also there are some barriers which have not been adjusted over the years, such as the number of students per classroom versus time to attend to a diversity that works at different styles and rhythms according to their needs. Another barrier is the training of teachers in inclusion issues mainly since the university curriculum (Angenscheidt Bidegain & Navarrete Antola, 2017), (Grijalba Bolaños & Estévez Pichs, 2020), (Saloviita, 2020).

Finally for the topic of (8) **robotics for inclusion**, eleven articles were selected that use robotics as a tool for educational inclusion in the last eight years. Different authors have found factors that make robotics an ideal tool for inclusion. Strengths such as interest, motivation, creativity, collaborative work, communication, and interpersonal relationships (dos Santos, Pozzebon, & Frigo, 2013), (Conchinha, Osório, & de Freitas, 2015), (Barrios, and others, 2015), (Conchinha CS, 2015), (Conchinha, Rodrigues, Nogueira, & de Freitas, 2016), (Newhart, 2016), (Conchinha CE, 2016), (Herrera González, 2018), (Delgado, 2019), (Daniela L. &, 2019), (Dave Catlin, 2019).

4. RESULTS

It is highlighted that the inclusive school that society asks for is the one that offers opportunities to all without distinctions or categories united by learning together (Blanco R., 1999), (Fernández, 2003), (Dussan, 2010), who seek to give what each child needs in their training (De la Cruz Flores, 2017) to improve their quality of life.

To serve to a diverse population, it is necessary to take into account some aspects that guarantee the acceptance, effectiveness in the process and that it is planned from the educational center's curriculum (Stainback, 1999), (Sarto Martín, 2009), which adapts to the diversity of the population that will receive, with methodologies, strategies and didactics (Iglesias Polo, 2017), which motivate and wake up the interest in their students (Gómez Gómez, 2017), that also promote the creativity and allow them to improve their social skills (Iglesias Polo, 2017), (Gómez, 2020) and that student can reach to a significant learning.

For topic 1 (**educational robotics**) where six predominant approaches are detected that appear in the interpretation phase in the methodology together with the citations of research found in the recent years:

The **interest** is highlighted by the authors in each of their studies to be decisive in achieving positive results driven by a favorable personal attitude of the student.

Motivation is a priority for the authors in their investigations which start from the observation of an object that fulfills a function and that through manipulation and changes in the programming, the student manages to set achievable objectives in a short time, it encourages them to go further according to his / her curiosity.

Social competencies are important in studies where teamwork prevails first because of the kits used, which are not enough for individual work and secondly because it seeks to arrange on ideas and set a common goal for the members, this strengthens the communication, the relationships, the collaboration and the leadership.

The **creativity** that goes linked with the conscious imagination, that is, that can be carried out, is a valuable element of robotics that allows to propose different designs until find a solution to the questions.

Problem solving where the student is faced with challenges of their own context related to their daily activities as well as throughout different analyzes and tests, they find solutions which at affective and emotional level have a positive influence on their cognitive development.

And finally, **meaningful learning** is reflected in the handling of concepts which are normally complex seen in theory but that regain meaning when are put into practice and associated in a productive process, seeing it since its applicability in its context.

For theme 2 (**inclusive education**) or education for all as a principle for schools around the world, international organizations continue leading this goal with the aim of serving to all diversity with equity and quality; One of the latest achievements is the 2030 agenda that ratifies that priority and that has been welcomed by the member countries of the UN, UNESCO and the European pillar. The studies found show that inclusion is a model that benefits all students (Guasp, Ramón, & De la Iglesia Mayol, 2016), (Blanco & Duk, 2019), since they are thinking about their differences and the best way to offer quality training with different strategies (Mitchell, 2020), where the authors prioritize: the team work, learning and rhythm styles, the processes, the autonomy (Guasp, Ramón, & De la Iglesia Mayol, 2016), (García Valiente, 2017), (Sarrionandia, 2017), (Valbuena, 2017), but also the barriers and challenges are highlighted which continue existing in many countries due to government policies that are not clear and leave doors open to shield responsibilities.

The teachers as protagonists of this process continue seeking training and better conditions to achieve with the expectations: being inclusive requires designing tools and strategies according to the diversity of the classroom and applying them under continuous and personalized monitoring. The change is born in the institutions in charge of education in each country according to its organization and restructuring of policies which are consistent with a classroom environment where there are resources, the knowledge and the enough personnel to face this challenge (Angenscheidt Bidegain & Navarrete Antola, 2017), (Grijalba Bolaños & Estévez Pichs, 2020), (Saloviita, 2020).

The topic 3 (robotic as inclusion tool), eleven studies found in the last years, coincide in the most of the predominant factors found in the studies about educative robotic: Conchinha with other researchers in four studies show positive results improving the motivation, the creativity the significant learning and the social

competencies (Conchinha C. S., 2015), (Conchinha, Osório, & de Freitas, 2015), (Conchinha C. E., 2016), (Conchinha, Rodrigues, Nogueira, & de Freitas, 2016), other researchers found strong points in interest and motivation (dos Santos, Pozzebon, & Frigo, 2013), (Barrios, y otros, 2015) y (Herrera González, 2018), which indicate that the way is positive and effective at using the robotics in the inclusion.

Figure 3 illustrates the main identified semantic elements, product of the analysis and synthesis process, where the investigation drives of applying robotics as an incentive and a way to push of the inclusion in the basic and secondary education levels. This semantic representation, allows to conceptualize (ontology type), how the educative robotic would permit to support as the emotional profiles (wanting to do) as the cognitive ones (can do), looking for keeping the convenient and demanded balance to promote social as inclusive education

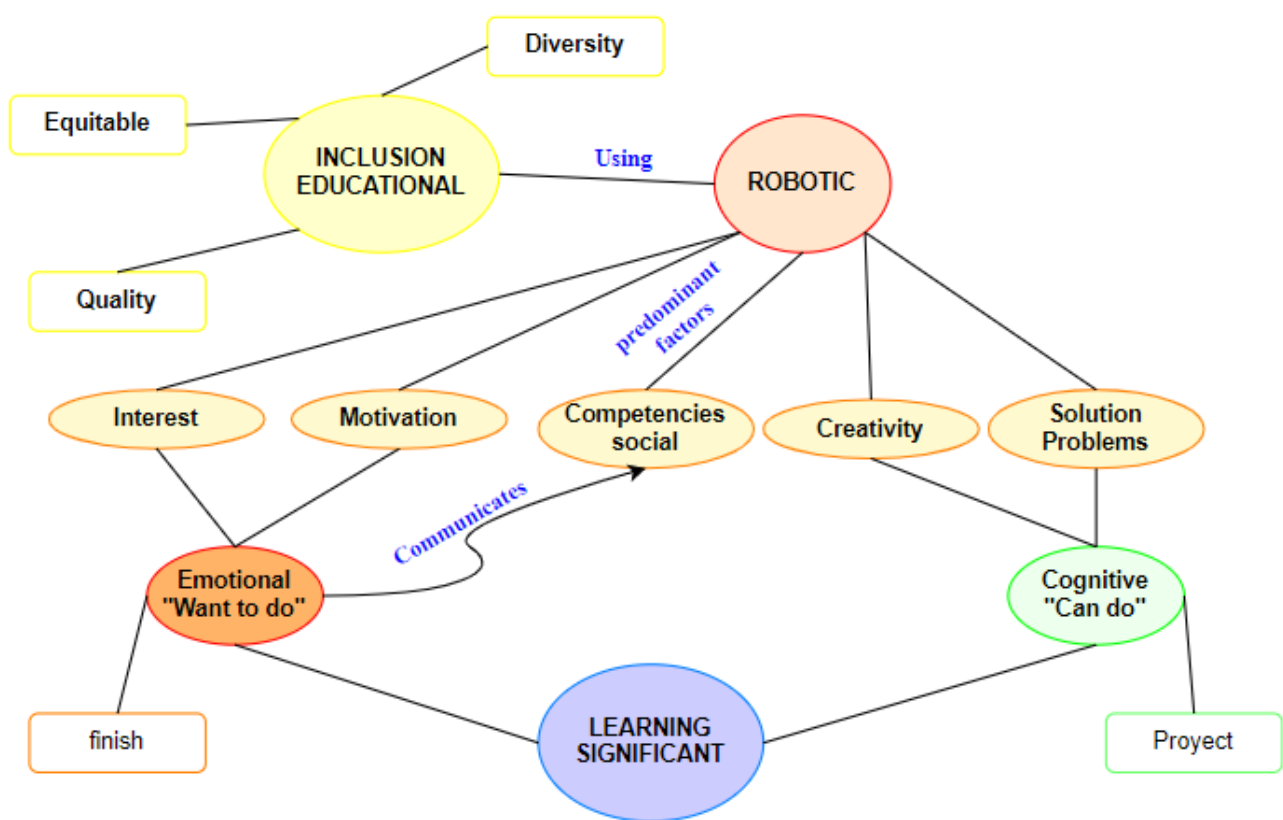


Figure 3 –Semantic of the robotic as support to the Inclusive Education

5. CONCLUSIONS

Educational inclusion under the pillars of equity and quality seeks the quality education by welcoming the diversity of students who are in the classrooms, for this, the robotics is a tool that contributes to the learning processes by providing the **emotional** component with two essential elements; the interest and motivation that could be identified by the phrase “**want to do**”, which will help the

student to set goals; these will need to communicate through the social competencies such as collaborative work, the communication, the leadership, and participation, among others. The second component that robotics provides is the **cognitive** one that can be identified with the phrase "**to be able to do**" and that should lead the student to develop abilities, skills, or competencies, it has two elements; creativity that seeks to propose different solutions to a problem, the solution of problems or needs set by the student based on his or her motivation; these two components, the emotional and the cognitive one, are manifested in the significant learning evidenced in the results obtained like response to their particular needs (Figure 3).

Something that is striking is that the studies analyzed (11) that relate robotics to educational inclusion, are mostly workshops that are applied to very small groups, something that does not reflect a reality of the Latin American public schools where the average number of students per group is about 25 or more. Another aspect to consider is the use in 9 of the 11 studies of high-cost robot-kits that are not referenced if they are existing resources in the institutions or provided by the researchers only for the study. Talking about inclusive schools based on the founded experiences is a task that requires greater investment and participation of the whole society, the educational robotics shows us that it is a viable way that generates positive results but that requires appropriated investment in equipment and training. Likewise, incentives are necessary in order the teachers are interested in the subject and want to train themselves by researching and proposing changes, but it is also necessary to adapt the policies and laws which are applicable to the reality allowing to dedicate the necessary time and resources to attend to diversity of students in public institutions that receive all type of population, a term that UNESCO proposes in 2011 as institutional management. The task has not been completed and therefore the gap continues and despite studies like this where is searched to understand the reality and move along, the international policies continue remaining on the paper because they are not entirely applicable.

REFERENCES

- Almeida, P., & Canarias, R. (2017). La robótica educativa: una oportunidad para la cooperación en las aulas. *Innovación docente y uso de las TIC en educación*.
- Angenscheidt Bidegain, L., & Navarrete Antola, I. (2017). Actitudes de los docentes acerca de la educación inclusiva. *Ciencias psicológicas*, 11(2), 233-243.
- Barrios, J., Kang, R., Morel, S., Kang, D., López, A., & Martínez Jara, E. A. (2015). Inclusión Tecnológica de Niños mediante Robótica Educativa de bajo costo. *X Congreso sobre Tecnología en Educación & Educación en Tecnología (TE & ET)*.
- Blanco, R., & Duk, C. (2019). El legado de la Conferencia de Salamanca en el pensamiento, políticas y prácticas de la educación inclusiva. *Revista latinoamericana de educación inclusiva*, págs. 25-43.
- Bustamante, J. A. (2018). Robótica educativa como propuesta de innovación pedagógica. *Gestión Competitividad e Innovación*. vol. 6, no 2, 1-12.
- Caballero González, Y. A., & García-Valcárcel Muñoz-Repiso, A. (2020). Fortaleciendo el pensamiento computacional y habilidades sociales mediante actividades de aprendizaje con robótica educativa en niveles escolares iniciales.
- Conchinha, C. E. (2016). Storytelling, robótica e inclusión: Un estudio de caso sobre el potencial inclusivo de la robótica virtual. *Actas de las Jornadas Virtuales de Colaboración y Formación Virtual USATIC*.
- Conchinha, C. S. (2015). La robótica educativa en contexto inclusivo. *Ubicuo social: Aprendizaje con TIC*.

- Conchinha, C., Rodrigues, A. C., Nogueira, A. P., & de Freitas, J. C. (2016). A robótica como ferramenta coadjuvante na formação e reabilitação de crianças com NEE Robotics as an auxiliary tool in the education and rehabilitation of children with SEN. *Conferencia Ibérica en Innovación en la Educación*.
- D'Abreu, J. V. (2017). Educación y Robótica Educativa. *RED. Revista de Educación a Distancia*(54), 1-13.
- da Silva Filgueira, M. G., & González González, C. S. (2017). Pequebot: Propuesta de un sistema ludificado de robótica educativa para la educación infantil.
- Daniela, L. &. (2016). The role of robotics in promoting the learning motivation to decrease the early school leaving risks. *The ROBOESL conference, Athens*, http://roboesl.eu/conference/?page_id=508.
- Daniela, L. &. (2019). Educational robotics for inclusive education.
- Dave Catlin, M. B. (2019). Designing Robots for Special Needs Education. *Technology, Knowledge and Learning*, 291-313.
- De la Cruz Flores, G. (2017). Igualdad y equidad en educación: retos para una América Latina en transición. *Educación*, 26(51), 159-178.
- del Río, M. B., García-Ruiz, R., & Rodríguez, M. A. (2018). La educomunicación como reto para la educación inclusiva. *EDMETIC*, 7(1), 66-86.
- Delgado, J. M. (2019). Robótica educativa en las aulas de Educación Especial. *EDUNOVATIC2019*.
- Eguchi, A. (2016). Robótica educativa para promover las competencias del siglo XXI. *Journal of Automation Mobile Robotics and Intelligent Systems*, 5-11.
- Gallardo, A. R. (2018). La Discapacidad y el nuevo Pilar Europeo de Derechos Sociales. *Siglo Cero*, 105-113.
- García Valiente, M. &. (2017). Robótica para todos en Educación Infantil.
- García, V. H., Duron, R. E., González, J. G., Aguirre, K. S., & Ramos, A. R. (2017). Robótica educativa para enseñanza de las ciencias. *Revista Electrónica sobre Tecnología, Educación y Sociedad*, 4(7).
- Gómez Gómez, M. &. (2017). Experiencia de trabajo de aprendizaje por interés. *Prácticas innovadoras inclusivas: retos y oportunidades*.
- Gómez, M. D. (2020). Factores que influyen en la educación inclusiva. *Educação Por Escrito*, 11(2), e31805-e31805.
- Grijalba Bolaños, J. G., & Estévez Pichs, M. A. (2020). La inclusión escolar, un reto para la formación de Licenciados en Educación. *Revista Universidad y Sociedad*, 12(1), 313-322.
- Guasp, J. J., Ramón, M. R., & De la Iglesia Mayol, B. (2016). Buenas prácticas en educación inclusiva. *Educatio siglo XXI. Vol 34 no.1*, 31-50.
- Guimarães, C. S., Rubio-Tamayo, J., Bayan Henrique, R. V., & Passerino, L. M. (2018). Desarrollo de un modelo de robot aplicado a la educación y simulación en entornos virtuales con ros: Especificaciones del modelo robot uniciclo edubot-v4. *Revista Educativa de Trabajos Orientados al Siglo XXI (RETOS XXI)*, 2(1), 74-87.
- Herrera González, E. (2018). Robótica educativa como herramienta de enseñanza-aprendizaje en personas con síndrome de down.
- Hervás-Gómez, C., Ballesteros-Regaña, C., & Corujo-Vélez, C. (2018). La robótica como estrategia didáctica para las aulas de Educación Primaria. *Hekademos: revista educativa digital*, (24), 30-40.
- Iglesias Polo, M. O. (2017). Liderando un proceso de inclusión de centro: CPR San José de Pontedeume. *Prácticas innovadoras inclusivas: retos y oportunidades*.
- Inclusiva., R. R. (17 de julio de 2019). *RREI Red Regional por la Educación Inclusiva*. Obtenido de Educación Inclusiva y de Calidad, una deuda pendiente en América Latina: <https://rededucacioninclusiva.org/estrategias-de-incidencia/educacion-inclusiva-y-de-calidad-una-deuda-pendiente-en-america-latina>
- Juan Barrios, R. K. (2015). *Inclusión Tecnológica de Niños mediante Robótica Educativa de Bajo Costo*. Centro de Investigación - Facultad Politécnica Universidad Nacional del Este .
- Lombana, N. B. (2015). Uso de la robótica educativa como estrategia didáctica en el aula. *Praxis & Saber.*, 215-234.
- Londoño Palacio, O. L., Maldonado Granados, L. F., & Calderón Villafañez, L. C. (2014). *Guías para construir estados del arte*.
- Marisol, A. C., Claudia, F. S., & Monica, N. L. (2015). Robótica Educativa: un entorno tecnológico de aprendizaje que contribuye al desarrollo de habilidades.
- Mitchell, D. y. (2020). *Lo que realmente funciona en la educación especial e inclusiva: utilizar estrategias de enseñanza basadas en la evidencia*. Routledge.
- Montés Sánchez, N. &. (2017). *Diseño de proyectos STEAM a partir del currículum actual de Educación Primaria utilizando Aprendizaje Basado en Problemas, Aprendizaje Cooperativo, Flipped Classroom y Robótica Educativa*.
- Mora Isidro, D. A., & Prada Castro, V. (2016). La robótica educativa como estrategia didáctica sostenible.
- Moreno, I., Muñoz, L., Serracín, J. R., Quintero, J., Pittí Patiño, K., & Quiel, J. (2012). La robótica educativa, una herramienta para la enseñanza-aprendizaje de las ciencias y las tecnologías. *Teoría de la Educación. Educación y Cultura en la Sociedad de la Información*, 74-90.
- Muñoz-Repiso, A. G.-V., & González, Y. A. (2019). Robótica para desarrollar el pensamiento computacional en Educación Infantil. *Comunicar: Revista científica iberoamericana de comunicación y educación*, (59), 63-72.

- Nabeel, M., Latifee, H. O., Naqi, O., Aqeel, K., Arshad, M., & Khurram, M. (2017). Robotics education methodology for K-12 students for enhancing skill sets prior to entering university. *IEEE International Conference on Robotics and Biomimetics (ROBIO)*, 1702-1707.
- Nemiro, J., Larriva, C., & Jawaharlal, M. (2017). Developing creative behavior in elementary school students with robotics. *The Journal of Creative Behavior.*, 70-90.
- Newhart, V. A. (2016). Virtual inclusion via telepresence robots in the classroom: An exploratory case study. *The International Journal of Technologies in Learning*, 23(4), 9-25.
- Orealc/Unesco. (2017). Declaración de Buenos Aires. E2030: Educación y Habilidades para el siglo 21.
- Ramírez, A. J. (2021). Educación inclusiva, medio y propósito de la educación para todos. *Educación inclusiva, medio y propósito de la educación para todos.*, 173-184.
- Ramírez, C. A., Quintero, D. M., & Builes, J. A. (2021). Un Ambiente visual integrado de desarrollo para el aprendizaje de programación en robótica. *Investigación e Innovación en Ingenierías*, 9(1), 7-21.
- Ramírez-Valbuena, W. Á. (2017). La inclusión: una historia de exclusión en el proceso de enseñanza-aprendizaje. *Cuadernos de Lingüística Hispánica*, no.30, 2011-2030.
- Román Graván, P., Hervás Gómez, C., & Guisado Lizar, J. L. (2017). *Experiencia de innovación educativa con robótica en la Facultad de Ciencias de la Educación de la Universidad de Sevilla (España)*.
- Román, A. H. (2017). La educación en la Agenda Internacional de Desarrollo. *Revista de Fomento Social* , 433-466.
- Romero, J. N. (2020). La robótica como recurso tecnológico para desarrollar habilidades blandas en los estudiantes de educación básica: Revisión sistemática. *Informatica Educativa Comunicaciones*, vol. 32, no 32.
- Saloviita, T. (2020). Attitudes of teachers towards inclusive education in Finland. *Scandinavian Journal of Educational Research*, 64(2), 270-282.
- Sánchez, T. S. (2019). La influencia de la motivación y la cooperación del alumnado de Primaria con robótica educativa: un estudio de caso. *Panorama*, vol. 13, no 25, 117-140.
- Sarrionandia, G. E. (2017). Educación inclusiva. Sonrisas y lágrimas. *Aula abierta*, vol.46 no2, 17-24.
- Valbuena, W. Á. (2017). La inclusión: una historia de exclusión en el proceso de enseñanza-aprendizaje. *Cuadernos de Lingüística Hispánica*, no30, 211-230.
- Valencia, U. I. (21 de 03 de 2018). *Perspectiva internacional de la educacion inclusiva: la situación en los países de nuestro entorno*. Obtenido de <https://www.universidadviu.com/perspectiva-internacional-de-la-educacion-inclusiva-la-situacion-en-los-paises-de-nuestro-entorno/>
- Vargas, H., Rosillón-Olivares, K., Garcia, K., Arrieta, M., Tancredi, A., Bravo, S., & Rodríguez, R. (2019). Robótica educativa: Un nuevo entorno interactivo y sostenible de aprendizaje en la educación básica. *Revista Tecnológica-Educativa Docentes* 2.0, 7(1), 51-64.
- Vivas Fernández, L., & Sáez López, J. M. (2019). *Integración de la robótica educativa en Educación Primaria*.
- Zapata, A. S., Costa, D. G., Delgado, P. A., & Torres, J. M. (2018). Contribución de la robótica educativa en la adquisición de conocimientos de matemáticas en la Educación Primaria. *Magister: Revista miscelánea de investigación*, 30(1), 43-54.