

Learning communities for the social appropriation of knowledge: cacti project

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Abstract

The objective of this paper is to generate a proposal for professionals in the educational, social, and cultural fields with an interest in contributing to the social appropriation and democratization of knowledge in CTel to strengthen the scientific culture by promoting community spaces based on participation and dialogue of knowledge based on four axes: community participation in STel, access to STel as a right, STel and community challenge (local and global problems), and STel and quality of life. The proposal is framed based on the following concepts: community of learning and participation for the promotion of a scientific culture, collective construction of solutions based on science to real problems, and contribution of social and community knowledge to science as empirical knowledge is taken into consideration for the construction of scientific knowledge. Some limitations are the heterogeneity of the members of learning communities requiring facilitators' experience and knowledge in managing groups that allow them to mediate the conversation

Keywords. democratization of knowledge, STEM education, community participation in CTel, scientific culture

Comunidades de aprendizaje para la apropiación social del conocimiento:
proyecto cacti

Resumen. -

El objetivo de este trabajo es divulgar una propuesta para profesionales del campo educativo, social y cultural con interés en contribuir a la apropiación social y democratización del conocimiento en CTel para fortalecer la cultura científica promoviendo espacios comunitarios basados en la participación y el diálogo, por medio cuatro ejes: participación comunitaria en STel, acceso a STel como derecho, STel y desafío comunitario (problemas locales y globales), y STel y calidad de vida. La propuesta se enmarca a partir de los siguientes conceptos: comunidad de aprendizaje y participación para la promoción de una cultura científica, construcción colectiva de soluciones basadas en la ciencia a problemas reales, aporte del conocimiento social y comunitario a la ciencia en tanto se toma en consideración el conocimiento empírico. Algunas limitaciones son la heterogeneidad de los miembros de las comunidades de aprendizaje que requieren experiencia y conocimientos de los facilitadores en el manejo de grupos que les permitan mediar en la conversación.

Palabras clave: democratización del conocimiento, educación STEM, participación comunitaria en CTel, cultura científica

I. Introduction

In Colombia, there are low levels of appropriation, valuation, and use of science, technology, and innovation (STI), which according to the National Council for Economic and Social Policy [1] are demonstrated from three main situations: decoupling of actors that promote, manage, and develop processes of social appropriation of STI SASTI, low participation from citizens in STI activities, and weak monitoring systems and indicators of the impact on the SASTI processes.

As a contribution to solving the previous problem, CACTI emerges: Cundinamarca Appropriates Science, Technology, and Innovation, STI, is a project of the Secretariat of STI of the Government of Cundinamarca operated by the science, technology, engineering, and mathematics (STEM) MD Robotics unit of the UNIMINUTO Social Innovation Science Park. The main objective of this project is to strengthen the culture of management and use of knowledge in STI in 67 municipalities of the department with participation from 12,000 children and young people, 1,600 STI managers, 400 community mothers or early childhood education representatives, and 200 teachers and trainers in STEM fields. The project is based on the development of the STEM MD robotics methodology for social transformation. This methodology is a commitment to strengthen the scientific culture in the department of Cundinamarca, from an inclusive perspective that brings citizens of various genders, generations, socioeconomic strata, and education levels closer to STI, considering the demands and requirements of today's society through robotics as a common thread and robots as didactic elements. With this perspective, citizens take on a leading role in constructing scientific knowledge wherein social and cultural values and the understandings they have about their own reality play a relevant role [2].

According to Sánchez and Macías [3], scientific culture implies that people have the capacity and ability to construct scientific ideas, rational arguments, analysis and interpretation of evidence, and ability to get involved and participate in social structures and practices that contribute to strengthening their knowledge in the field of science. This allows for finding scientific culture in daily life to make STI applicable in social, concrete, and relevant contexts'

The goal is to strengthen participants' knowledge that will allow them to expand and renew skills to research, implement, and manage projects, processes, and resources for STI, use knowledge and experiences for individual and collective well-being, and build spaces for social participation in relation to decision-making on the development of technical-scientific solutions while learning about science at local learning communities, composed of people of different genders, ages, ethnicities, and social and cultural conditions [4].

In the framework of CACTI, a learning community is understood as a group of people who build knowledge collaboratively using common tools and sharing the same environment. According to Betancourt and López [5], González [6], and Beltrán et al. [7], learning communities meet four characteristics: 1) they value the cultural intelligence present in the people who participate, 2)

they try to transform the cultural environment to move from less favorable to more favorable conditions, 3) they build dialogue and cooperation to mediate the knowledge building process, and 4) they are guided by the principle of inclusion considering that everyone can learn and contribute their own knowledge and experience in the same environment and achieve a common objective.

The learning communities within the framework of the CACTI project are governed by the following principles that mediate their participants' interaction, considering that they are made up of people with generational, educational, cultural, and gender differences and have different life experiences. These principles are listed as follows:

The methodology is based on horizontal dialogue or knowledge dialogue, recognizing that participants have knowledge and experiences with the same level of importance. It is not about replicating a banking education process wherein it is understood that there are people who do not possess knowledge. For this reason, they need experts to teach them what they need. In contrast, the different actors (children, youth, communities, researchers, and technicians) offer their knowledge in horizontal dialogue to build new knowledge and new frames of reference around STI, that is, they all put their knowledge (technical, empirical, scientific, and popular) at the service of the process.

Acosta et al. [8] indicate that the knowledge dialogue is a possibility arising from the assumption that all human beings have knowledge to share. In this sense, the space that is provided for knowledge building becomes the stage for this dialogue to take place in conditions of equality, plurality, diversity, and democracy for knowledge to enter the conversation.

Cooperation is required between members of the same community and other communities to identify real problems in context and determine possible solutions (with other communities to strengthen proposed solutions).

Calvo notes that cooperation considers the recognition of competences and capacities from different related actors, therefore, "it is the human capacity to adopt a perspective of ourselves to develop and implement common projects highly beneficial for all those involved" [2].

Plurality is the diversity of opinions, positions, and cultural and social values that coexist in learning communities, wherein actors have the freedom to express under equal conditions [9] indicates that the plurality of knowledge is important to promote participation as it allows critical and reflective dialogue between communities. This promotes the enrichment of each participant with consideration to their cultural reference framework, which in turn, contributes to the preservation of cultural identity while exercising their freedom of expression. In learning communities, people with diverse cultural, gender, religious, political, and age conditions interact and build relationships based on respect for difference.

Inclusion seeks to include in the STI processes, as an affirmative action, people and populations that due to their socioeconomic and geographical conditions may be excluded from these processes. This includes rural populations, disabled people, ethnic groups, and populations with limited economic resources. However, inclusion does not mean that the methodology is not open to citizens of all classes and social and economic conditions.

In its declaration on science and the use of scientific knowledge, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) indicates that scientific teaching, without discrimination, is a fundamental prerequisite for democracy and sustainable development. UNESCO also argues that the benefits derived from scientific advances are unevenly distributed

due to the structural asymmetries that exist in countries like Colombia and along the same lines between social groups and genders. In this sense, "what distinguishes the poor (whether people or countries) from the rich is not only that they have fewer assets but also that the vast majority of them are excluded from the creation and benefits of scientific knowledge" [10].

Empathy is the ability to observe, perceive, understand, and feel objectively what is happening to another. This "another" is understood as other people, communities, living beings, and the environment. Empathy drives collaboration, altruism, and mutual support.

Having established the principles that guide the interaction of learning communities, it is necessary to clarify that within the framework of the CACTI project, they are related in two types of spaces: a virtual one, mediated by a web platform that is used to create a large virtual community from interacting and exchanging experiences, knowledge, and learning. This learning arises from local and face-to-face meetings that facilitate knowledge building, generate trust, establish common frames of reference, understand and analyze the local social reality, and exchange knowledge and experiences with communities present in other territories of Cundinamarca.

This methodology's implementation is mediated by communication from a development communication perspective that seeks to create new languages, narratives, and media that facilitate circulating content between the learning communities and those with the social context, thereby understanding communication as a fundamental process to transform scientific culture. Therefore, it is understood not as a means, product, or instrument but as a process that mediates the interaction between different actors present in the experience and contributes to constructing new frameworks of meaning around STI.

Under this premise, the objective of this paper is to generate a proposal that allows professionals from the educational, social, and cultural fields to contribute to the SASTI and transform scientific culture by promoting community spaces based on the participation and dialogue of knowledge sources. The proposal is developed under the methodology that is addressed in the following section.

II. Development

The proposal developed in this section consolidates community spaces that facilitate the promotion of participation to strengthen the scientific culture that manages and values STI as drivers of local development. The participating communities aim to have the capacity to analyze the importance of STI in improving life quality and conditions by understanding the relationship between STI, daily life, and local challenges, and recognizing access to scientific knowledge as a right from understanding its role as a generator of well-being to comprehending citizen participation in issues related to STI, thereby facilitating resource management and access to technology.

To achieve the above-mentioned objectives and implement the proposal, the following thematic focal points are considered: participation in STI, access to STI as a human right, and relationship between STI–community challenge (local and global problems), STI, and comprehensive human development. Each of these focal points is expanded below:

Community participation in decision-making related to the use, management, and definition of public policies related to STI is currently considered as a right that leads citizens to become aware of their role in overcoming various manners of exclusion and bridge the existing gaps in society in terms of access to benefits granted by development based on STI, which seems to be reserved for certain sectors of society in developing countries, such as Colombia.

In this sense, the Colombian Observatory of Science and Technology (OCyT) understands public participation in science and technology “as a set of diverse situations and activities, which can be more or less spontaneous, organized, and structured, involving contributions from nonexperts to establish agendas, decision-making, policy formation, and knowledge production processes”.

The national strategy for the social appropriation of STI considers participation as “an organized process that enables the exchange of opinions, views, and information between different social groups, and also encourages dialogue on problems in which scientific and technological knowledge plays a leading role, with the intention that these groups make a specific decision”.

Community participation in the framework of STEM robotics for social transformation becomes a political action to empower and raise awareness among its participants regarding the importance of contributions and recognizing their rights of access to science, mainly in relation to accessing spaces to strengthen capacities, resources, and opportunities offered by STI for personal, community, and territory development. This is expressed in different elements of methodological development as the real problem in context is identified by participants themselves through a reflective process and through the proposed potential solutions based on STI. Simultaneously, participants facilitate spaces for the development and strengthening of capacities for the use, management, and utilization of STI considering their needs and characteristics.

Based on the United Nations (UN) declaration on the use of scientific and technological progress in the interests of peace and humanity's benefit, which is enshrined in resolution 3384 of November 10, 1975, scientific progress is considered as one of the most important developmental factors of the human society. This fact is in consideration of the scientific and technological progress made to improve the living conditions of people, which also contributes to solving social problems that threaten human rights and fundamental freedom of the people [11], [12], [13].

Although it is true that this is necessary for human development, it seems to be a neglected issue. The democratization of knowledge is understood as the publication of research results in specialized journals so that they are publicly accessible to academic communities; however, what about access to knowledge by grassroots communities? This perspective is exclusive. According to Jiménez, "democratizing knowledge is not only promoting open access to research resources but also is a way of apprehending that information encourages and promotes citizen participation, allowing them to have an informed opinion on issues of public interest" [14].

A. STI and Community Challenge (Local and Global Problem)

From this focal point, the problem defined by learning communities is constructed with alternative solutions that they propose during participation in the project. It seeks to generate a space for dialogue around different solutions to identify elements of convergence, consensus, and feedback to alternative solutions. In addition, it identifies the relationship that exists between STI and the solution of concrete challenges of daily life communities while learning about STEM areas.

In this sense, the proposal generates spaces that enable the relationship between science and daily life applied to the solution of real and concrete problems. Perales-Palacios and Aguilera [15] indicate that young people can identify social problems, but they still do not connect with them as objects of reflection in science. That is, they identify the situation and understand the concepts, but they cannot relate the information obtained by applying it to solve problems and transform their reality.

B. STI and Quality of Life

The quality of life as a complex and multidimensional concept includes objective conditions (material) and subjective well-being (perception of well-being). In this sense, STI contributes to people, communities, and families having better living conditions in relation to health, education, access to information, productive environment, etc.

It is important that participants of the CACTI project identify the direct relationship that exists between STI and the improving quality and conditions of personal, family, and community life, the relationship between STI and economic growth is witnessed as the driver to achieve and maintain competitive advantages in the market. However, this condition does not always lead to an increase in the well-being and quality of life of societies. On the contrary, in several cases, it is perceived as disconnected.

C. Strategy with Learning Community Encounters Dialogue Spaces on STI

The strategy of the process of social appropriation of knowledge is proposed based on meetings with learning communities and dialogue spaces on STI. Within the framework of the project, these meetings are understood as spaces for conversation between the members of the ACs and other project stakeholders related to scientific developments, local, regional, and national experiences on applying STI in specific cases, knowledge of regional spaces that facilitate SASTI, importance of STI for development, reflection on local and global problems, and how robotics contributes to solving them, state of robotics in the country, and knowledge of rights around STI.

D. Techniques and Instruments

Some of the techniques and tools used during the gatherings will be as follows:

- Roleplay. A dramatization in which the participants assume a previously established role; useful to address issues that are difficult to understand or make decisions.
- Cases that Narrate and Inspire. Case studies of community construction of technology to solve concrete problems in a community.
- Call for Experts. Recognition of Colombian scientists and regional spaces to approach science, such as museums and science centers.
- Community Scientists. Integration of the scientific method into practical and everyday life
- Experimental Laboratories. Conducting game-based experiments
- Log. An instrument that facilitates the recording of learning and new discoveries based on self-evaluation and hetero-evaluation.
- The Development of Focused Dialogue on Thematic Topics. It should be clarified that the proposal is flexible and can be adapted based on the needs and goals of the process.

III. Methodology

The meetings developed around this focal point consider the following steps:

Consolidation of Learning Communities. This aspect is fundamental as it seeks to generate a space to sensitize participants on the importance of working in the logic of the learning community by recognizing guiding principles such as participation, dialogue of knowledge, cooperation, respect for plurality, diversity, and inclusion, and generating empathy for local problems and their consequences for individual and collective well-being.

Building the Collective Dream: It aims at defining a common objective (where they want to go as a community) and the route that will lead to achieving the objective, and defining elements that offer an identity (for e.g., name, logo, and slogan).

Community Participation in STI. This conversational space aims to provide an answer from the perspective of participants to the question, that is, why is it important to participate in decision-making processes in STI? In addition, recognizing citizen participation in science as a right and of spaces for citizen participation in STI in Cundinamarca, such as the Regional Councils of Science, Technology, and Innovation and the existence of local STI Committees that are consultative and social representation spaces for decision-making.

In addition, STI and local development, public policy on STI in Colombia, participation of children and young people in STI.

Science and Technology in Cundinamarca. This includes spaces for access to scientific and technological knowledge: learning about science (museums and regional science centers), scientists from Cundinamarca

Focus on Access to Scientific Knowledge as a Right. This includes generator of well-being and development; it raises the specific question of what does it mean that access to scientific knowledge is a fundamental right for all citizens? It also includes declaration on the use of scientific and technological progress in the interests of peace and for the benefit of humanity.

STI and Quality of Life Focus. Science and technology are closer than we think. How can we improve the quality of life of our families and communities through the use and knowledge of STI?

Focus on STI and Community Challenge, Practical Application of Scientific and Technological Knowledge. This includes collective construction of resolution ideas; it raises the specific question related to science and technology beyond discourse, that is, how does it contribute to solving my practical and everyday problems?

IV. Results

The methodological proposal is based on an instructional design. It is a commitment to building social knowledge by generating spaces for dialogue to promote social change in participating communities regarding how they perceive and relate to each other with STI. The process combines dialogue techniques and collective construction of concepts, experiences, and learning revolving around what STI mean in direct relation to the practical applications to specific problems in participants' daily lives and their community. The spaces for dialogue value participants' prior knowledge, considering them to be the protagonists of the process and recognizing their social, cultural, and environmental characteristics.

This proposal is aimed at people interested in working with the communities for the social appropriation of knowledge in STI under the principles of the STEM methodology, professionals in social and human sciences, educators, and social and cultural managers passionate about STI and fully convinced of the importance of these fields for the comprehensive development and improvement of citizens' quality of life. Those who apply to this proposal will have the necessary tools that allow them to develop decision-making skills in communities; promote social and democratic participation in matters related to STI; develop empathy for local and global problems; and create awareness regarding solutions to overcome poverty, inequality, and exclusion and achieve high quality of life for individuals, families, and communities.

Conclusions

In conclusion, the methodology combines the following concepts: learning community and participation to promote a scientific culture. In this sense, robotics is the common thread, the manner that allows citizens to approach scientific knowledge through the application of principles of physics, mechanics, biology, mathematics, etc., and to develop computational, logical, critical, and creative thinking skills, thereby understanding robots as a pedagogical element. The learning communities are represented in the environments in which empirical, scientific, cultural, social, and robotics values converge. All the above is mediated by communicative and participatory processes.

they make a social contribution to science as they are considered to build scientific knowledge. In this framework, the process contributes to strengthening the scientific culture in Cundinamarca by connecting STI with specific social contexts.

Some limitations in implementing this proposal that should be considered are the heterogeneity of the members of the learning communities as openness is required to work with people of different conditions of gender, age, and experiences. This implies that the facilitators have experience and knowledge in group management, which in turn, allows them to mediate the conversation if conflicts arise during meetings. They must also promote the participation of children and young people and ensure that their voices are heard on equal terms.

Those who are interested in implementing this proposal are recommended to consider the sociocultural context of communities, starting from their needs and previous experiences that serve as case studies, as this influences the extent to which the communities have different experiences in terms of the relationship with STI.

The experiences of the UNIMINUTO Social Innovation Science Park should also be considered, which is a benchmark in processes of social appropriation of knowledge, recognized by both public and private actors at the regional and national levels.

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References

- [1] CONPES. (2016). Política nacional de Ciencia, Tecnología e Innovación (documento borrador) [National Science, Technology, and Innovation Policy (draft document)]. CONPES.
- [2] E. García, J. González, J. López, J. Luján, M. Gordillo, C. Osorio, C. Valdés. Ciencia, Tecnología y Sociedad: una aproximación conceptual [Science, technology, and society: A conceptual approach]. OEI. 2019
- [3] M. Sánchez, N. Macías. "El papel de la comunicación pública de la ciencia sobre la cultura científica: acercamientos a su evaluación". Revista Eureka sobre Enseñanza y Divulgación de las Ciencias, 1-13. https://doi.org/10.25267/Rev_Eureka_ensen_divulg_cienc.2019.v16.i1.1103, 2018
- [4] C. Quintero. "Enfoque Ciencia, Tecnología y Sociedad (CTS): perspectivas educativas para Colombia", Zona próxima (12), 222-239. 2019
- [5] Z. Betancourt, P. López. "Propuesta para la identificación de factores que influyen en el desarrollo de habilidades del pensamiento crítico: Estudio de Caso de la Institución Educativa rural Adolfo León Gómez, Municipio de Pasca Cundinamarca". Corporación Universitaria del Minuto de Dios. <https://repository.uniminuto.edu/handle/10656/5795>, 2010
- [6] M. González. "Papel de la Innovación en el desarrollo local sostenible". COODES, 8(1). <http://coodes.upr.edu.cu/index.php/coodes/article/view/295>, 2020
- [7] Y. Beltrán, Y. Martínez, O. Torrado. "Creación de una comunidad de aprendizaje: una experiencia de educación inclusiva en Colombia". Revista Encuentros, 57-72. <http://www.scielo.org.co/pdf/encu/v13n2/v13n2a04.pdf>, 2019
- [8] L. Acosta, M. Pinto, C. Tapias. "Diálogo de saberes en comunicación: colectivos y academia". Universidad de Medellín. 2019
- [9] P. Calvo. "Reciprocidad cordial: bases éticas de la cooperación. Ideas y Valores", Ideas y valores, 66(165), 85-109. 2016
- [11] J. García. "La comunicación de la ciencia y la tecnología como herramienta para la apropiación social del conocimiento y la innovación". JCOM – América Latina, 02(01), Y02. <https://doi.org/10.22323/3.02010402>. 2019
- [12] UNESCO. (1999, Month Day). Declaración sobre la ciencia y el uso del saber científico Adoptada por la Conferencia mundial sobre la ciencia el 1o de julio 1999
- [13] ONU. (1975, November 10). Title of section/document. <https://www.ohchr.org/SP/ProfessionalInterest/Pages/ScientificAndTechnologicalProgress.asp>
- [14] A. Jiménez. Democratizar el conocimiento, la agenda pendiente. Estudios sobre las Culturas Contemporáneas, XIV (48), 5-8. 2019
- [15] F. Perales-Palacios, D. Aguilera. Ciencia-Tecnología-Sociedad vs. STEM: ¿evolución, revolución o disyunción? Ápice. Revista de Educación Científica, 4(1), 1-15. <https://doi.org/10.17979/arec.2020.4.1.5826>, 2019

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