

Critical partner approach in collaborative learning of renewable energy sources- RES-

Guevara-Sáenz de Viteri Jéssica, MSc, ¹Naranjo-Valencia Margarita, MSc² Delgado-Plaza Emérita, Ph.D, ³ Peralta Jaramillo Juan, Ph.D ⁴

1. Universidad de Guayaquil, Ecuador, Miembro de OIICE ; jessica.guevaras@ug.edu.ec Orcid 0000-0003-1148-0014.

2. Universidad de Guayaquil, Ecuador margarita.naranjov@ug.edu.ec Orcid 0000-0002-7771-8649

3 . ESPOL Polytechnic University, Escuela Superior Politécnica del Litoral, ESPOL, FIMCP-CDTS, Campus Gustavo Galindo Km, 30.5 Vía Perimetral, Guayaquil P.O. 09-01-5863, Ecuador, eadelgad@espol.edu.ec,

4 . ESPOL Polytechnic University, Escuela Superior Politécnica del Litoral, ESPOL, FIMCP-CDTS, Campus Gustavo Galindo Km, 30.5 Vía Perimetral, Guayaquil P.O. 09-01-5863, Ecuador, jperal@espol.edu.ec

Abstract– *The purpose of this work is the adaptation of collaborative learning, with the socio-critical model that allows the development of general competencies, during professionalization combining theory and praxis through knowledge through group interaction (collaborative work); resulting in the promotion of basic courage such as sustainability cooperation, as well as the ability to solve problems related to the use of renewable energy sources (RES)*

The Ebook responds to the professional profile of graduates in Environmental Education and Community Development Sciences; as well as the sciences. Average of 60% of those consulted agree that it stimulates autonomous intellectual training linked to the judgment of the care of local renewable resources and that the illustrations used strengthen courage such as sustainability in the proper use of renewable resources..

Keywords-- *Collaborative learning, Critical Partner Approach, General Competencies, Basic Courage and Renewable Energy Sources.*

I. INTRODUCTION

The development of science and technology, globalization and the age of knowledge, generate impacts on education and the workplace, which are directly related and have been a reason for countries to design university education policies. [1]

Therefore, the challenge in education referred to by Edgar Morín is that he must take as an action and practice in the educational reforms of the 21st century “knowledge is to navigate in an ocean of uncertainty through archipelagos of certainties” Edgar Morín “Los seven knowledge necessary for the Education of the Future” [2] humanity, which today is debated between two globalizing helices: the four-engine composed of science, technology, industry and economic interest, and humanist and emancipatory ideas of man. Edgar Morín “The seven knowledge necessary for the Education of the Future”. [2] The seven knowledge for the education of the future, information and elements must be placed in context to make sense; It must be considered that the global is more than the context, in this way a society is more than a context "is an organizing whole of which we are part" Edgar Morín "The seven knowledge necessary for the Education of the Future". [2]

Digital Object Identifier (DOI):

<http://dx.doi.org/10.18687/LACCEI2020.1.1.415>

ISBN: 978-958-52071-4-1 ISSN: 2414-6390

The society and the human being are complex units, that is to say multidimensional.

Morín points out that education should promote a "general intelligence" apt to refer in a multidimensional way, to the complex, to the context in a general conception. Edgar Morín “The seven knowledge necessary for the Education of the Future.

[2] Education must promote the natural aptitude of intelligence to ask and solve essential questions and stimulate the total use of general intelligence, which implies stimulating curiosity, which is often extinguished by current instruction. Teaching the human condition must be the central axis of present and future education, because in the planetary era, human beings “must recognize themselves in their common humanity, and at the same time, recognize the cultural diversity inherent in everything that is human” Edgar Morín “The seven knowledge necessary for the Education of the Future”. [2]

The transformations of the globalized context, the vertigo in the production of knowledge, the latest technologies or the new functions delegated to the Training Institutions, undoubtedly press and encourage new challenges in curricular policies regarding: curriculum and its relationship with standards of learning and evaluation; curriculum and situation and role of teachers; curriculum and diversity in all its dimensions: personal, gender and culture. With these considerations and taking into account the guidelines of the Regional Project and Education for Latin America and the Caribbean - PRELAC. [3] that challenges the senses of learning.[4]

The profile of a professional in sciences and humanities responds, to a set of knowledge, skills and attitudes, which operationally determines the general and particular actions that will be developed in its different fields of action, aimed at solving previously specified needs with characteristics that integrate the concepts of teaching and learning corresponding to the social, economic, political and cultural factors that must be incorporated into the training itinerary. To define a curriculum, it is necessary to know the social tensions and problems that converge in the field in which they work. [5]

The higher institutions of education develop redesigns in their curricula, based on various studies of supply and demand, social need, which will allow the generation of professionals with their own skills, abilities, competences and domains that guarantee their participation in specific areas of their profession.[5] [6] In this case the ESPOL Escuela Superior Politécnica and Universidad de Guayaquil, in accordance with the provisions of the Constitution of the Republic [7] and other rules attributed in Education, which require that HEIs respond in training professionals of excellence, socially responsible, leaders, entrepreneurs, with moral and ethical principles and courage, contributing scientific, technological, social, economic, environmental and political development of the country; and, when doing research, innovation, technology transfer and quality extension to serve society. [8] [9] [10]

ESPOL financed the elaboration of the ebook through the Latin-Project, however the academic vision of the ebook authors is to apply it in general courses for a better understanding of the R.E.S. at undergraduate level.[11]

II. CRITICAL PARTNER APPROACH

The socio-critical approach seeks to transform the learning style based on the experiences and reflections of which it is directed, to make the subjects generate critical and reflective awareness so that in this way he can manage his own criteria. It is built from everyday problems, social courage and political positions. [12]

The development of the person in society prioritizing needs interests and problems of their environment. [9] For this, the teacher as a knowledge- building entity having the ability to innovate and link students in research processes, creating a horizontal and participatory relationship. [13] [14]

This evaluation process must be done individually and collectively with theory, praxis and debates of collaborative learning. Among the most important characteristics of the critical partner applied to the educational field are: a) the adoption of a global and dialectical vision of the educational reality, b) the shared acceptance of a democratic vision of knowledge, as well as the processes involved in its elaboration; and c) the assumption of a particular vision of the theory of knowledge and its relations with practical reality. [15]

The same that are present in: the autonomy of the individual for the development of judgment and criticism; intellectual processes; basic courage in sharing, cooperating and being supportive; carry out the objectives of a course through dialogue and discussions; practice is the theory of action; the contents must be socially significant and the construction and learning activities shared; negotiation and

consensus of the groups that lead to understand reality. [16] See the figure 1.

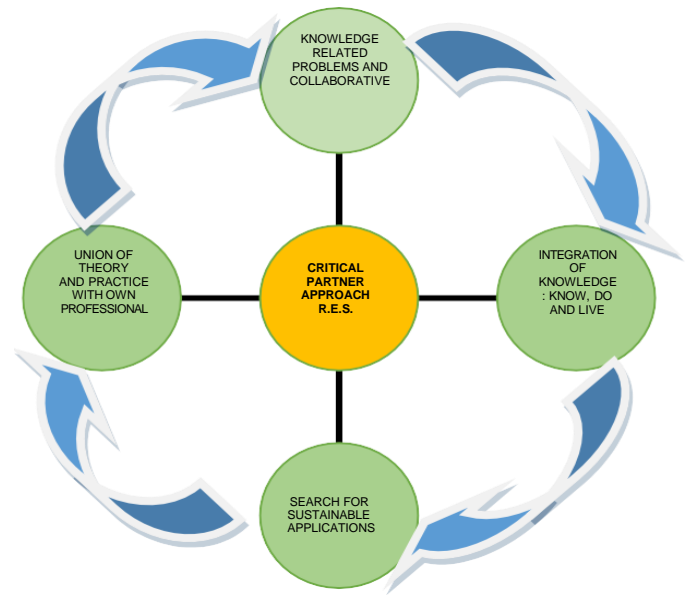


Fig. 1 Critical socio-learning approach of RES.
Source: Own authors year 2020

The socio-critical approach to learning from renewable sources of energy, allows the student to have a vision of space and time, which if said otherwise represents an action around reality. Taking into account the tensions and problems existing in the field, with a global look and global addressing. This will allow you to make use of your practical knowledge in order to solve a problem with a responsible and social sense. [17]

Taking this to an illustration of the theory-practice, towards the integrality of knowledge, the student is empowered of the situation (KNOW), looking for effective alternatives (KNOW AND DO) to reduce the index of environmental pollution, whether they are notable in factories, industries and / or community, developing a work through effective actions that allow reducing (CONVIVENCE) its degree of contamination in its processes and allowing a harmonious coexistence with the community. See figures 1 and 2. The subject uses the action, looking for alternative solutions to solve the problem allowing social harmonic coexistence. [17]

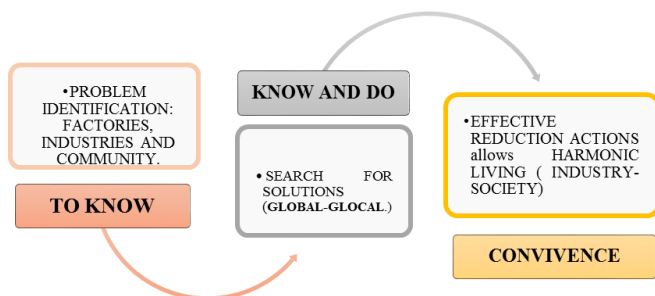


Fig. 2. Comprehensive knowledge with a partner approach and collaborative learning in RES
Source: Own authors year 2020

III. ADAPTABILITY WITH COLLABORATIVE WORK

Learning is a complex process that consists of different competences that converge in the final formative result. [18] The training of these students requires the development of general skills such as: creativity, interest in learning, critical thinking (ability to think with their own judgment) communication skills, ability to solve problem situations, make decisions, adapt to changes and work in teams, have logical and formal thinking. [19] [6]

Collaborative work is a system of interactions that organizes and induces reciprocal influence between the subjects that are linked to the development of a learning activity. The same, which is carried out through gradual process in which each subject and all its members feel committed to learning of others, generating interdependence that does not imply an individualistic competences. For this, it is necessary that its members share their knowledge regarding their group purposes and with the proposed activity. [6] [9]

This learning can be supported by the socio-critical approach, which is based on social criticism with a strong reflexive author character; considers that knowledge is always built by interests that start from the needs of the groups; It seeks the rational and liberating autonomy of the human being using technology and strategies that allow personal and social skills to be demonstrated in the subject, making each of its members feel responsible not only for their learning, but for the remaining members of the group. [20] [14]

A. Steps for the development of collaborative activities:

1. Selection of the activity, the one that must contemplate: Problem solving, conceptual learning, divergent thinking, creativity, and others.
2. Decision making regarding: group size, allocation, materials, among others.
3. Performing group work
4. Supervision of the groups

Figure 3 illustrates the concrete actions in the teaching-learning process designed by the teacher and the student. Based on theoretical in Renewable Energy Sources and collaborative learning strategies for groups participation in discussion, forums and debates that activate reflexive critical thinking to solve problems housed in work practice. With this adaptation the quality in the training of the subjects is improved and it will be more significant for the student and his role in the classroom. Being present the active participation of the student in the search for specific solutions addressed in the area of knowledge be these for their intervention in activities of educational, environmental sustainable nature. Through these events they propose open and flexible methods with useful strategies to improve the processes in the respective environments, typical of the training and attributable to the SDGs (Sustainable Development Goals) number four and seven, linked to the use of clean energy and to quality education. [17]

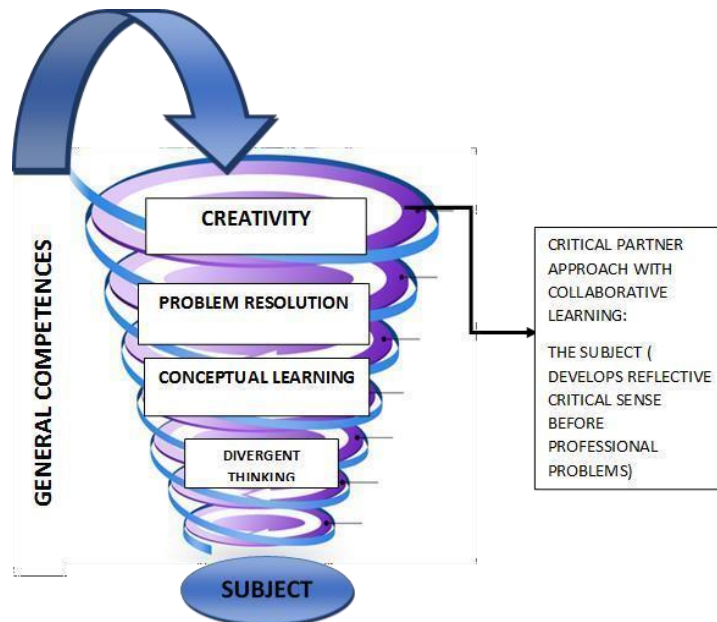


Fig. 3. Adaptation of collaborative learning with the use of skills
Source: Own authors year 2020

IV. METHODOLOGY

The Latin Project with Latin American initiative involves 12 universities of the European Union and Latin America, for the creation of works (ebook), which are intended to provide technological tools for the generation of texts to teachers, researchers university students in different areas of knowledge, aimed at students of institutions in higher education in Latin America. The objective of this project was the initiative to create and disseminate open books, designed for and from Latin America.

The ebook had a Creative Commons license so that in the future other teachers can modify them and adapt them to their courses, translate or distribute them, according to their needs at no cost.

The methodology used is the formation of groups, the aforementioned work (ebook) on the theme of the use of Renewable Energy Sources, it offers the reader the basics in eight chapters arranged according to the different types of energetic resources. There are central chapters such as the resource: Solar, Water, Wind, and Biomass examples used for each case. [17]

This knowledge is attributed in the graduation profile of students in exact sciences and humanities, considering that they are conditioned on their occupational training, capacities for participation in the development and development of projects, analysis of productive processes, calculating and putting into practice the different technical solutions that minimize the negative effects of the industrial process by applying awareness in preserving the environment, with a comprehensive approach.

For this purpose, graphs with statistical data and analysis of results are presented based on the survey made to the students for the evaluation of the ebook with respect to presentation and content defining their contribution in the teaching environment as a didactic tool for specialties with their respective subjects, both for students in the field of engineering and education.

This text used methodological learning strategies that will allow readers-students to know and apply knowledge in renewable energy source, with the purpose of developing in them skills and abilities to propose ideas that generate solutions to environmental problems, and socio- production related to obtaining energy. Theoretical examples were used using: explanatory graphs, diagrams. [14] This will allow the proposed objectives to be met in each of its learning units defined in the text. [21]

Formative processes were applied, which serve as the basis for decision-making regarding the options and actions that are presented during the teaching-learning process, the reader- student will be able to pass from a level of ignorance in the subject of renewable energy sources, at a level that allows to be considered as a leveler in the different problems posed in the contents defined in chapters in the text; thus developing the ability to assemble related discussion topics. [22]

It is defined in 5 steps of strategies applied specifically with students, considering the training based on competence:

1. Context study
2. Understanding the problem

3. Search for alternatives
4. Selection of the best alternative
5. Execution scenario [9]

For the generation of results and the understanding of the contents established in the book, that allow the student to acquire progressive knowledge in the eight chapters, whose purpose is to combine the progressive and participative learning of the study, associated to examples and projects executed in Ecuador that have looked for the use of clean energy and exploitation of the energies: wind, solar and use of biomass in order to improve the quality of life of the localities [23]

The results of the application of this model in the creation of the e-book contribute with the development of SKILLS, SKILLS OR COMPETENCES such as:

1. Knowledge of the current landscape of renewable energy sources and the basic principles of application,
2. Ability to interpret the demand and supply of energy in an energization system.
3. Ability to evaluate the environmental and socioeconomic aspects of the use of renewable energy,
4. Basic knowledge of energy transformation processes,
5. Ability to identify and interpret information in the field of renewable energy sources,
6. Decision making in aspects related to renewable energy sources. [24] [9][10]

Through the technologies proposed in the text, it is intended to ensure that the reader (student) finds constant relationship with personal characteristics and professional skills

This e-book collects material based on investigations of the current situation, thus determining the feasibility of participating in the globalization trend that involves the development of new technologies that use renewable energy sources. [11] A very practical example to be cited in the work is the didactic way of exposing other points of view of the use of BIOMASS, which is considered a clean energy from waste biomass [25]

Student readers received the official test version, expressed criteria and comments for subsequent adjustments to the content of the chapters of the work.

V. RESULTS AND DISCUSSION

In the search for results on the applicability of the text of Introduction to the Study of Renewable Energy Sources in the field of humanistic sciences, surveys were conducted of 110

graduates of the Bachelor of Science in Education and Environmental Community Development who attended the subject Energy and Environment, which keeps correspondence in third level careers of the Faculty of Philosophy, Letters and Education Sciences of the Universidad de Guayaquil This sample corresponds to the Fourth Course who in their curriculum approved the subject Energy and Environment.

The survey fulfilled the purpose of assessing: 1) the content of the ebook; 2) Graphic illustrations about the conceptual framework on renewable energy sources; 3) the correspondence of the contents with the objectives set out in each of its chapters and 4) Usefulness of the examples in the text as supporting material that fosters the socio-critical approach in the micro-curricular activities of the careers. [26]

It should be noted that the questions relate the characteristics of the socio-critical model combined with collaborative learning, which are described below:

- Autonomy of the individual reflected in the judgment of courage (care of renewable resources) and intellectual training.
- Development of basic values such as solidarity and vulnerability.
 - Promotion of dialogue and discussion
 - Promotion of practical actions.
 - Shared learning through constructive activities, and significant content
 - Group techniques that understand reality
 - Diagnostic of problems and propose solutions. [27]

The result of the questions asked in the survey is shown below. Table I and Fig 3 show the results of the assessment about the relationship of the content of the ebook as a contributor to the intellectual training of the reader, accompanied by the judgment of courage with respect to the care of existing renewable resources in Ecuador.

¿ Considers that content of the ebook stimulates autonomous intellectual training linked to the judgment of the care of local renewable resources?

TABLE I

ASSESSMENT OF INTELLECTUAL TRAINING AND COURAGE JUDGMENT

Valoration	Frecuency	Results
Strongly agree	63	57%
In agreement	39	36%
Indifferent	8	7%
In disagreement	0	0%
Very disappointed	0	0%
Total	110	100%

Source: Surveys of graduates in Environmental Community Development 2018

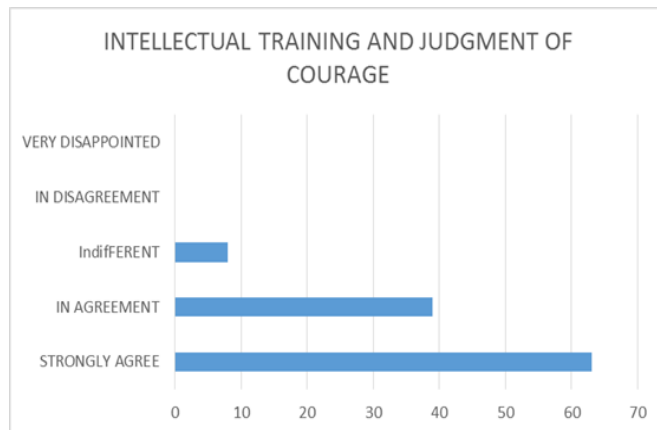


Fig 4 Valoration Assessment of Intellectual Training and courage judgment

Source: Own authors year 2020

Likewise, it was evident that the graphic illustrations existing in the conceptual framework were able to strengthen the basic courage in the readers, such as: cooperation, sustainability and solidarity in actions for the sustainable use of renewable resources in Ecuador as well as the liberation of criteria in application of possible alternatives for the combination of the use of renewable energy sources. According to abiotic conditions existing in local region. This was linked to the topics that the teacher taught during the teaching of the subject of Energy and Environment, using the ebook as a collaborative tool. See table II and Fig 5.

After using ebook. Do you consider that the ebook illustrations used during the subject of energy and environment consolidates courage such as sustainability in the proper use of renewable resources?

TABLE II

ASSESSMENT OF INTELLECTUAL TRAINING AND COURAGE JUDGMENT

Valoration	Frecuency	Results
Strongly agree	68	62%
In agreement	37	34%
Indifferent	5	4%
In disagreement	0	0%
Very disappointed	0	0%
Total	110	100%

Source: Surveys of graduates in Environmental Community Development 2018

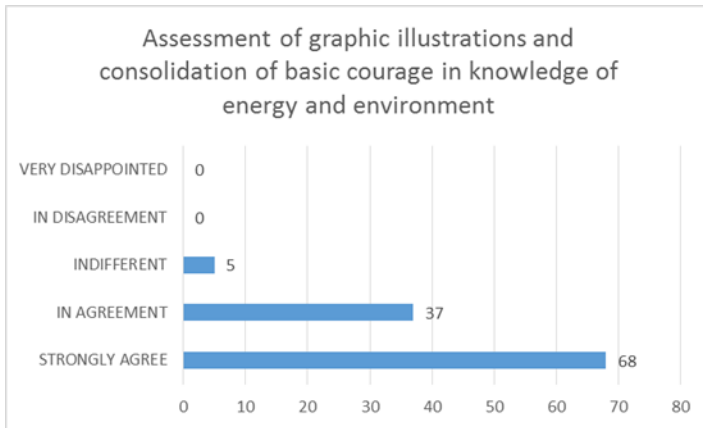


Fig 5 Assessment of graphic illustrations and consolidation of basic courages in knowledge transfer of energy and environment subject
Source: Own authors year 2020

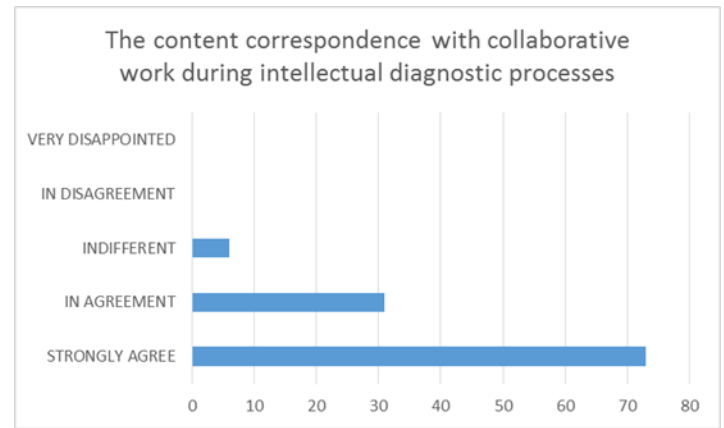


Fig 6 Assessment of content correspondence with collaborative work during intellectual diagnostic processes
Source: Own authors year 2020

The survey included the correspondence of the significant contents with the objectives set out in each of the chapters of the ebook during the intellectual learning process through the basic knowledge building activities of renewable energy sources.

Collaborative learning takes place through structured groups during classes, which are assigned the review of examples that allowed diagnosing environmental collateral problems in the use of renewable energy sources and their possible remedial alternatives. [28]

Consider the example of problems of landscape disorders due to the use of solar panels or the installation of wind generators near natural reserve areas, observing sessions in which additional discussion forums were opened on alternatives based on environmental impact studies of similar existing projects that influenced the increase in collaborative classroom work. [23] [29] See Table III and Fig 6.

Do you consider that ebook maintains correspondence in its contents with the proposed objectives and encourages collaborative work during the diagnostic process by combining the analysis of problems in the use of renewable energy sources?

TABLE III
ASSESSMENT OF CONTENTS CORRESPONDENCE WITH COLLABORATIVE WORK DURING INTELLECTUAL DIAGNOSTIC PROCESSES.

Valoration	Frecuency	Results
Strongly agree	73	66%
In agreement	31	28%
Indifferent	6	6%
In disagreement	0	0%
Very disappointed	0	0%
Total	110	100%

Source: Surveys of graduates in Environmental Community Development 2018

In Fig 6, it is confirmed that 66% of the graduates consulted perceive that the activities proposed within the contents of the ebook. They foster collaborative work and group dialogues combined with discussion forums become a group technique that allows them to understand the reality of conceptual application.

VI. CONCLUSIONS

The ebook contributes to the construction of collaborative learning under the socio-critical approach by the person making use of strategy; hence it is considered the center of the teaching-learning process, taking into account the active role and participation in activities collaborative, such as the formation of tutorial groups and self-study activities. The survey reported 66% acceptance.

The logical design of the content of the work allows fostering the development of skills through decision making, search capacity, information analysis and its inherent relationship with the environment through the solution of real problems from the use of renewable sources of energy.

The development of reflective socio-critical thinking can be appreciated through the usefulness of the examples in the text as support material that promotes the micro-curricular activities of the Environmental Community Development career combining the science of discovering the fundamentals of energy and its invention in everyday life, that is, in both cases problems are solved by creativity and lateral or divergent thinking of the application of concepts.

The 63% of the respondents confirm that ebook involved the application of the collaborative learning strategy during the sequential presentation of the basic concepts related to renewable energy sources, with emphasis on the development of basic courage such as: cooperation, sustainability and, solidarity in actions for the sustainable use of renewable

resources in Ecuador; linked to deep thinking, knowing how to do and attitudes.

The readers of the work expanded the concepts and made connections with each other, applying real-world situations and conducting their future environmental assessment

Finally, the ebook induces the reader to participate in discussion forums that allow critical reflection on the combination of the use of renewable resources in the different scenarios of Ecuadorian areas, as well as the development of collaborative learning through the use of examples

ACKNOWLEDGMENT

The ebook was funded by the Latin Project Project executed in ESPOL- Escuela Superior Politécnica del Litoral through the Information Technological Center (ITC) between 2013 and 2014 and the co-authors wish to express their gratitude to: Eng. Gladys Carrillo, Texts Diagrammer; Dr. Xavier Ochoa, MSc. André Ortega, Eng. Naara Pérez and MSc. Margarita Ortiz for support logistic ITC-ESPOL.

To Ministerio Casa Bíblica for logistic support. Mr Edgar Rodríguez, Lcda.Judith Rodríguez and Eng. Freddy Flores

To the senior co-author, Eng. Alfredo Barriga Rivera PhD(+), who prepared the base notes of classes on which some chapters of the work were elaborated.

To graduates of the Bachelor of Science in Environmental Education and Community Development at the Universidad de Guayaquil

REFERENCES

- [1] SENPLADES. (2017) Plan Nacional de Desarrollo “Toda Una Vida” 2017-2021. Quito-Ecuador, pág. 148 www.planificacion.gob.ec.
- [2] Morín, E. (1999) Los siete saberes necesarios para la educación del futuro. Publicado en por ONU <http://edgarmorinmultiversidad.org>.
- [3] UNESCO. (2015). Los Sentidos de la educación. PRELAC, 98. Obtenido de <https://unesdoc.unesco.org/search/N-EXPLORE-aba4067e-33cf-4831-8897-f44b19686859>
- [4] Organización de Estados Iberoamericanos para la Educación, la Ciencia y la Cultura-OEI (2012) Metas educativas 2021-CEPAL – OIE. La educación que queremos para la generación de los Bicentenarios. ISBN: 978-84-7666-224-3
- [5] Díaz Francisco (2016). Libro Didáctica y currículo: un enfoque constructivista, Barcelona- España. ISBN 9788484271604 <http://dx.doi.org/10.15517/iuscr.v17i36.27100>. https://www.celec.gob.ec/hidronacion/images/stories/pdf/P_LANEE%20version%20espa%C3%B1ol.pdf
- [6] Mareque, M. y De Prada, E. (2018). Evaluación de las competencias profesionales a través de las prácticas externas: incidencia de la creatividad. Revista de Investigación Educativa, 36(1),
- [7] Constitución de la República del Ecuador (2011) https://www.oas.org/juridico/pdfs/mesicic4_ecu_const.pdf
- [8] Larrea, E., & Montalván, M. (2017) Modelo Ecológico de la Universidad de Guayaquil www.uq.edu.ec
- [9] Colina Vargas Alejandra (2017) Competencias docentes en la enseñanza de la educación superior en el Ecuador. Coedición Universidad ECOTEC ISBN 978-9942-960-26-9 NO. Pág. 118
- [10] Mas, O. y Olmos, J. (2016). El profesor universitario en el Espacio Europeo de Educación Superior. La autopercepción de sus competencias docentes actuales y orientaciones para su formación pedagógica. RMIE, 21(69), 437-470. Recuperado de <http://www.redalyc.org/pdf/140/14045395005.pdf>
- [11] Memorias INPIN Investigación para la Innovación , Seminario Latinoamericano de Postgrado e Investigación (2016) Analysis of solar energy potential derived off in situ solar radiation measurements in Atahualpa – Santa Elena. Ecuador . ISSN CD- ROM 2550-6560 / ISBN 978-9942-92038-6. DOI: 10.13140/RG.2.2.32252.33925.
- [12] Ortiz Ocaña Antillas, A. (2009) Diccionario de la Pedagogía, Ediciones Cepedi, España.
- [13] Larrea, E. C. (2016). Los estándares intelectuales y el desarrollo del pensamiento crítico en el nivel Básica superior de la Unidad Educativa González Suárez. Ambato-Ecuador Obtenido de <https://repositorio.uta.edu.ec/handle/123456789/24115>
- [14] Vargas Montealegre Alba Ruth & García Ortiz Paula Andrea (2017) Competencias directivas, un reto para la educación superior, Revista Academia & Virtualidad 10(1): 11-22, DOI: <https://doi.org/10.18359/ravi.2088>.
- [15] Unzueta , S. (2011). Algunos aportes de la psicología y el paradigma socio crítico a una educación comunitaria crítica y reflexiva. Integra Educativa, 4 (2), Recuperado. Obtenido de <http://www.scielo.org.bo/pdf/rieiii/v4n2a06.pdf>
- [16] Vargas , A., & Rendón, L. (s.f.) (2015) Enfoque socio crítico en la formación docente en la UPEL-IPB. Educare, 16. Obtenido de <http://es.slideshare.net/aliriotua/el-enfoque-socio-critico-en-la-formacion-docente>.
- [17] Ministerio de Electricidad y Energía Renovable (2019) Plan Nacional de Eficiencia Energética-2035. Ecuador
- [18] Estrada García Aurora (2016) Estrategias didácticas bajo el enfoque de competencias: aplicación del uso de herramientas de forma interactiva. Revista Iberoamericana para la Investigación y el Desarrollo Educativo ISSN 2007 - 7467, Vol. 6, Núm. 12. https://www.celec.gob.ec/hidronacion/images/stories/pdf/PLA_NEE%20version%20espa%C3%B1ol.pdf
- [19] Carrasco Alejandro y Flores Luis M. (2019) De la reforma a la transformación –Capacidades, innovación y regulación de la Educación Chilena. Santiago- Chile. SBN: 978-956-14-2391-6
- [20] Anijovich, Cappelletti, Mora, & Sabelli. (2009) Transitar la formación pedagógica. Dospositivos y estrategias. Buenos Aires : paídos.
- [21] Sandí Juan, Cruz (2016) Propuesta metodológica de enseñanza y aprendizaje para innovar la educación superior. Revista de las Sedes Regionales, vol. XVII, núm. 36, pp. 2-38. Universidad de Costa Rica Liberia, ISSN:2215-245 <https://www.redalyc.org/pdf/666/66648525006.pdf>. DOI:<http://dx.doi.org/10.15517/iuscr.v17i36.27100>.
- [22] CEDDER. (2007). Gestión de las energías renovables, perspectivas de Futuro, 6a edición, Madrid España, CIEMAT
- [23] Martínez, J. (2013) Como generar masivamente electricidad calor y frío con la energía de la tierra. Unión española de Geotérmica. Primera Edición. España (Primera ed.). Madrid, España.
- [24] Villardón Gallego, L. (2010) Planificar desde competencias para promover el aprendizaje, Benos Aires-Argentina
- [25] Instituto de Investigación Geológico y Energético IIGE (2018) Balance Geológico Energético. Ministerio de Energía y Recursos Naturales No Renovables.
- [26] Luque , A. (2010) Handbook of Photovoltaic Science and Engineering, Edited by Antonio Luque Instituto de Energía Solar, Universidad Politécnica de Madrid, Spain
- [27] Vargas Montealegre Alba Ruth & García Ortiz Paula Andrea (2017) Competencias directivas, un reto para la educación superior, Revista Academia & Virtualidad 10(1): 11-22, DOI: <https://doi.org/10.18359/ravi.2088>.

- [28] Valeriano Ruíz , M., & Silva (2016) Energías Renovables , 5o de Ingeniería Industrial. Sevilla: escuela Superior de Ingenieros Universidad de Sevilla.<https://www.edfsolar.es>.
- [29] Méndez , R. (2014) Energía Solar térmica . ECA Instituto de Ecnología y Formación. Editorial FC. España,