

Intercultural research in university linkage in Ecuador

Investigación intercultural en la vinculación universitaria en Ecuador

Investigação intercultural na ligação universitária no Equador

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Abstract: The need for university-society linkage is internationally recognized, the knowledge that is built contributes to the transformation and development of the community in general. The study aims to analyze intercultural research from the university linkage in Ecuador, specifically addresses the pedagogical strategy that relates the appropriation of integrative content in the transfer of knowledge at the high school level from teachers and students of the Pedagogy of Experimental Sciences of Mathematics and Physics of the Faculty of Pedagogy of the Technical University Luis Vargas Torres of Esmeraldas-Ecuador. The results reveal an increase in the level of intercultural investigative competence of the students who develop the pre-professional practices of community service, located at the level of use of

technological applications, which made possible the improvement of the academic performance of high school students from the execution of a pedagogical strategy, in the same way, it was valued that its practical implementation is a carrier of transformations that overcome the traditional forms of teaching and learning. It is concluded that the university linkage can be extensively implemented in the context of research-interculturality, corroborating the purpose of overcoming the inadequacies presented in the research-training-intercultural formation, as well as the competences of the students involved in this research.

Key words: research; interculturality; knowledge transfer; pre-professional practice; competencies.

Resumen: La necesidad de la vinculación universidad-sociedad es reconocida a nivel internacional, los saberes que se construyen aportan a la transformación y desarrollo de la comunidad en general. El estudio tiene como objetivo analizar la investigación intercultural desde la vinculación universitaria en Ecuador, específicamente se aborda la estrategia pedagógica que relaciona la apropiación del contenido integrador en la transferencia de saberes a nivel de bachillerato desde los profesores y estudiantes de la carrera Pedagogía de las Ciencias Experimentales de Matemáticas y Física de la Facultad de la Pedagogía de la Universidad Técnica Luis Vargas Torres de Esmeraldas-Ecuador. Los resultados revelan un incremento del nivel de competencia investigativa intercultural de los estudiantes que desarrollan las prácticas preprofesionales de servicio comunitario, situado en el plano de uso de aplicativos tecnológicos, lo que posibilitó el mejoramiento del desempeño académico de los alumnos del bachillerato a partir de la ejecución de una estrategia pedagógica, de igual manera, se valoró que su implementación

práctica es portadora de transformaciones que superan las formas tradicionales de la enseñanza y el aprendizaje. Se concluye que la vinculación universitaria puede ser instrumentada extensivamente en el contexto de investigación-interculturalidad, se corrobora el fin de superar las insuficiencias que se presenta en la formación investigativa - formativa - intercultural, así como las competencias de los estudiantes involucrados en esta investigación.

Palabras clave: investigación, interculturalidad; transferencia de saberes; práctica preprofesional; competencias.

Resumo: A necessidade de ligações universidade-sociedade é reconhecida internacionalmente; o conhecimento que é construído contribui para a transformação e desenvolvimento da comunidade em geral. O estudo visa analisar a investigação intercultural da ligação universitária no Equador, abordando especificamente a estratégia pedagógica que relaciona a apropriação de conteúdos integrativos na transferência de conhecimentos a nível do ensino secundário de professores e alunos da Pedagogia das Ciências Experimentais de Matemática e Física da Faculdade de Pedagogia da Universidade Técnica Luis Vargas Torres de Esmeraldas-Ecuador. Os resultados revelam um aumento do nível de competência de investigação intercultural dos estudantes que desenvolvem estágios de serviço comunitário pré-profissional, localizados na utilização de aplicações tecnológicas, o que permitiu melhorar o desempenho académico dos estudantes do ensino secundário a partir da implementação de uma estratégia pedagógica, da mesma forma que se avaliou que a sua implementação prática é portadora de transformações que superam as formas tradicionais de ensino e aprendizagem. Conclui-se que a ligação universitária pode ser amplamente implementada no contexto da investigação-interculturalidade, corroborando

o objetivo de ultrapassar as insuficiências apresentadas na investigação-formação-formação-intercultural, bem como as competências dos estudantes envolvidos nesta investigação.

Palavras-chave: investigação, interculturalidade; transferência de conhecimentos; prática pré-profissional; competências.

INTRODUCTION

The linkage constitutes a substantive function of higher education institutions and a key component of the nation state. This process also shares the field of international relations with increasingly powerful non-state actors, to whom we often respond without objections, because this is imposed by lending agencies when commitments are made to them.

Unfortunately, sometimes occurs through bonding a process of recolonization, in which (Santos, 2018):

"Sovereignty is being eroded as powerful states and non-state actors unite to seize control of natural resources and people's lives in poor states. Capitalism today is experiencing one of the most destructive moments in its recent history, as witnessed by new forms of primitive accumulation by dispossession, the re-enactment of colonial rapine, now spreading throughout the global South" (p. 26).

In this recolonizing scenario, apparently absent from the interests of teachers, students and various social groups, there is an urgent need to develop decolonizing pedagogical processes, in order to act with awareness of what is established in the legal framework that currently regulates the operation of Higher Education Institutions in the Republic of Ecuador.

In this regard, it is essential to pay attention to what is expressed in Art. 117 of the Organic Law of Higher Education (LOES), paragraph 3, which defines as substantive functions of higher education institutions the teaching, research and linkage with society (LOES, 2010). This entails, in a sustained manner, the planning and execution of articulated actions to contribute to local and national development on a permanent basis, through community service work or linkage with society in Art.8, of the Law itself (LOES, 2010).

Likewise, the linkage and its adequate impact and quality are rights of the students of Higher Education Institutions (HEI). In this regard, Art. 13, paragraph a) LOES (2010) states that the right to Higher Education must be guaranteed through teaching, research and its linkage with society, and ensure increasing levels of quality, academic excellence and relevance.

It should be noted that the Constitution of the Republic of Ecuador (2018) also provides important guidelines regarding the purposes of the linkage process. Article 343 states that the purpose of the national education system shall be the development of individual and collective capacities and potentialities of the population, which enable learning, and the generation and use of knowledge, techniques, knowledge, arts and culture. Art. 350 states that the purpose of the higher education system is academic and professional training with a scientific and humanistic vision; scientific and technological research; innovation, promotion, development and dissemination of knowledge and culture; and the construction of solutions to the country's problems, in relation to the objectives of the development regime.

Article 351 states that the higher education system shall be articulated with the national education system and the National Development Plan, where the principles of responsible autonomy, co-government, equal opportunities, quality, relevance, comprehensiveness, self-determination for the production

of thought and knowledge, within the framework of the dialogue of knowledge, universal thought and scientific, technological and global production shall govern.

These aspects of the current legal framework reflect the importance of the linkage process established between the university and society, and in particular the importance of developing this process between careers and educational units in the education system.

The transformations that are taking place globally and in Latin America affect universities in their essence; the management of university processes is confronted with new conditions, whose characteristics are the acceleration and constant transformation of the environment in all aspects. Universities must develop the management of their processes with the capacity to interpret this complexity and to contribute to reconfigure the institutions and make them more flexible to changing scenarios. Didriksson (2000)

The axis of these transformations is the articulation of the relationship between the university and society, with the transfer of knowledge and technologies of networks that go beyond campuses, institutes and faculties, which are determined in the strategies of countries, regions and the world as a whole. The contradictory dialectical relationship between the process of linking a pedagogical career with the educational units of the education system, are the expression of the dialectical relationship of the linking of the University - Society at the level of the Education System.

The present study aims to analyze the intercultural research from the university linkage in Ecuador, specifically the pedagogical strategy that relates the appropriation of the integrative content in the transfer of knowledge at the high school level, in teachers and students of the Pedagogy of Experimental Sciences of Mathematics and Physics (CPCEMF), belonging

to the Faculty of Pedagogy of the Technical University Luis Vargas Torres of Esmeraldas-Ecuador. This research was generated from the linkage project entitled "The FACPED promoting educational development, culture, ancestral knowledge and creation in the province of Esmeraldas.

Linking the university to society: A theoretical perspective

The needs of today's society are increasingly specific and concrete, which means, as Guarnizo (2018) states, professional training must be consistent with this reality. The university-community link must establish a social commitment of the first category (integrative content), regarding the satisfaction of the demand for people prepared and capable of facing the social problems that affect and that integrates the second category (practical linkage and transfer of knowledge).

In this sense, universities prioritize the training of professionals equipped not only with adequate knowledge to understand the social reality but also with competencies to transform it in favor of the development of society, hence, the importance of training these competencies from pre-professional practices (Guarnizo, 2018).

According to the Council of Higher Education (CES), in chapter 3, article 89 indicates that pre-professional internships are learning activities oriented to the application of knowledge and the development of specific skills and abilities that a student must acquire for an adequate performance in his/her future profession (CES, 2013). These internships must be of research-action and will be carried out in an institutional, business or community, public or private environment, appropriate for the strengthening of learning; in addition, they constitute a fundamental part of the curriculum.

Ecuadorian universities assume the execution of various projects of linkage with the community as part of their social responsibility, in order to contribute to the transformation of society. In this, the relationship between cultures and the dialogue that involves cultural interaction subsists, which is a transcendental element in education because according to (Rodríguez and Fernández, 2017) interdisciplinary project proposals (integrative and classroom) are channeled with the participation of Educational Units, presupposes a qualitative leap oriented towards their constant improvement of academic, research, intercultural performances; as well as, of specific competencies, besides establishing the ways for the conception of these, in correspondence with the new institutional objectives, which direct the lines of linkage and domains. A key theoretical basis of this study is the "Management Model for the linkage with society", called DVS-ULVR (Pazmiño, Cortez and Maldonado, 2019). It gathers the necessary edges to achieve quality standards of university linkage (university-educational units integration), aligned with institutional objectives and attention to the needs of society to achieve optimal academic performance. This model makes it possible to understand the methodological and organizational structure, which allows cohesion between society, public and private organizations, and Higher Education Institutions (HEI), with respect to the achievements that are reached both immediately through their results, as well as the impact generated over time (Pazmiño, Cortez and Maldonado, 2019).

Another theoretical basis of the present study is the Collaborative Resonance Model, which in the linkage practices bases the connection established between the learning of students in university education, with experiences and needs of the educational units; this connection is made through learning communities mutually constructed between the university and the Unified General Baccalaureate (BGU), having as a fundamental link the professional

practices (Sayago, 2006). This model brings together interests, knowledge and university situations with needs that become spaces for learning, places where permanent, systematic and critical inquiry takes place. Under this perspective, internships promote lasting, coordinated relationships, not exclusively to carry out occasional experiences but to originate research and innovation projects, where the ideas of both teachers and students of the Higher Education Institutions and the Unified General Baccalaureate complement each other.

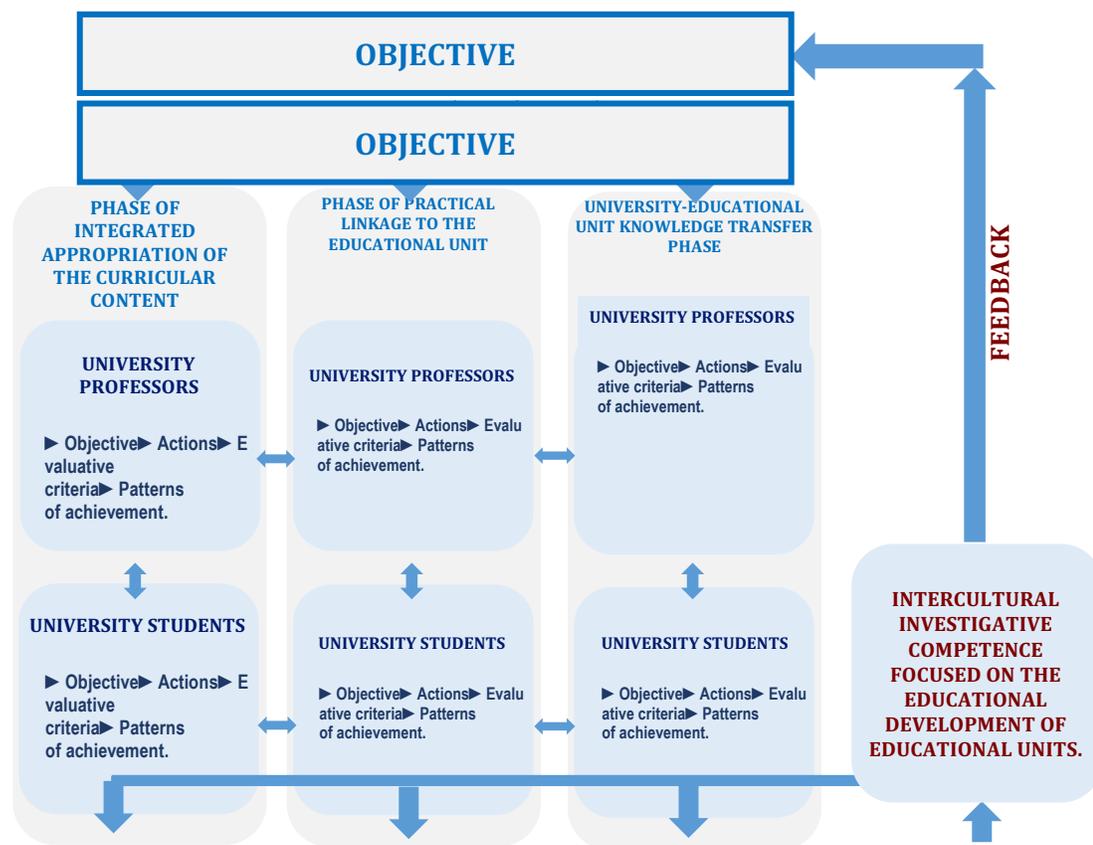
However, it is through research that teachers in training can approach the experience of practice as an opportunity to deepen their self-knowledge and to systematically seek solutions to professional problems that arise in the educational environment in which they are immersed. This purpose necessarily entails the development of investigative competencies by practitioners in which diversity in their cultural identity must be recognized, among which the following processes stand out: inquiry, observational, reflective, propositional, technological, interpersonal, cognitive, procedural, analytical and communicative (Buendía, Zambrano and Alirio, 2018). For Arroyo (2016) and Walsh (2008), interculturality would be an "epistemological alternative that leads us to consider the way in which we relate to the other and the diverse, beyond fragmentations and in favor of an ethnic, cultural and linguistic openness where new modes of social relationship occur" (p.187).

Tapia (2020) contributes, from the approach of a Model of the Dynamics of Intercultural Research Competence Formation. This model reveals the systematization of the appropriation of intercultural research competence, from considering the dialectical relationships between the intervening practice of intercultural research in the intercontextuality and the

development of professional performance. As a fundamental methodological basis, the present study was systematized from the pedagogical strategy of appropriation of the integrating content for the practical linkage and transfer of knowledge between the university and the educational units. (see figure 1).

Figure 1. Representation of the pedagogical strategy for the appropriation of the integrating content for the practical linkage and transfer of knowledge between the

Pedagogical strategy of appropriation of the integrating content for the practical linkage and transfer of knowledge between the university and the educational unit.



educational units towards academic performance [Own elaboration].

The objective of this strategy is to orient university professors and students of the Experimental Sciences Pedagogy of Mathematics and Physics career, on the pedagogical ways that should be carried out for the formation of the investigative competence focused on the educational development of the General Unified High School (BGU) in the city of Esmeraldas-Ecuador.

The pedagogical strategy is structured in three phases, called: integrative appropriation of curricular content, practical linkage to the educational unit and transfer of knowledge between the university and the educational unit. Each of them has a specific objective, a system of actions to be developed by university professors and students, as well as evaluation criteria and achievement standards for both types of actors. The efficient implementation of the pedagogical strategy requires the following conditions and requirements to be managed:

- Commitment of the teaching staff to understand and assimilate the theoretical bases that support the pedagogical strategy, as well as its structure and function.
- Correct implementation of the current legal framework for the execution of the substantive functions of teaching, research and liaison with society, in order to contribute to local and national development on a permanent basis, through community service work or liaison with society.
- Flexibility of the educational teaching process that facilitates the introduction of new approaches to improve intercultural-research pedagogical training oriented to the development of the practice of community outreach.
- Existence of a Consulting Group (integrating project) in charge of the correct application of the pedagogical strategy, which advises the rest

of the university professors and students regarding the objectives, actions, evaluation criteria and achievement standards.

- Preparation of the teaching staff in charge of managing the pedagogical training oriented to the community outreach practice, based on the development of the three phases of the pedagogical strategy and the evaluation of the intercultural investigative competence focused on the educational units.
- Existence of minimum material resources, especially computers and a technological infrastructure that guarantees the efficient use of Innovation and Communication Technologies (ICTs) that enable students to design use processes to facilitate the understanding of the relationship between mathematical or physical data in its dimension: concrete-graphic-abstract.
- Working agreements in force with the educational units that allow an adequate environment for the proper practical linkage of university students, the diagnosis of needs, the transfer of knowledge and the development of the community; from the guidance, accompaniment and evaluation of university professors.
- Methodological work of the teaching staff that enables an adequate transdisciplinary integration of the different curricular contents that makes it possible to evaluate their functionality with respect to the integrating and linking projects proposed by the students through the use of ICTs.

The phase of integrating appropriation of the curricular content aims to achieve a high level of learning of the curricular content in the university student, establishing links between the different scientific disciplines and evaluating its functionality in the resolution of the main problems existing in

the community context, from the use of ICTs, the methodology of scientific research and its knowledge and experience base.

In order to achieve the stated objective, this phase contains several actions, as well as evaluative criteria and achievement standards aimed at university professors and students. The achievement standards for university students in this phase are the following:

PL-1. *Level of assimilation of functional curricular content:* this is determined by the student's mastery of those curricular contents that are key to his or her pre-professional practical activity.

PL-2. *Level of formation of professional pedagogical competencies:* which is verified from the self-regulation of the real and efficient performance during their academic training, in correspondence with the desirable performance model, socially constructed in a multicultural context.

PL-3. *Level of integration of curricular contents:* demonstrated in the effectiveness of selecting the technological, communicational, pedagogical and didactic contents for the satisfactory development of a scientific task associated with its project of linking, use and application of ICTs.

On the other hand, the *practical linkage phase of the career aims* to apply scientific research and new knowledge to the educational practices of the educational units from the linkage project, in order to diagnose their training needs oriented to the educational, research and knowledge development that are transferred to it mediated by the use of ICTs to promote the understanding of the solution of mathematical and physical problems. Similarly, this phase has several actions aimed at achieving the defined objective. In addition, it

contains the evaluation criteria and achievement standards for teachers and university students.

The patterns of achievement for college students in this phase are as follows:

PL-4. *Level of sensitivity and awareness of intercultural research:* demonstrated during the scientific inquiry in the execution of the linkage project, based on criticism, tolerance and acceptance of the educational needs of the actors of the educational units, within the framework of the relations of culturally diverse groups.

PL-5. *Level of intercultural knowledge apprehension:* which is evidenced by the level of recognition, resignification and integration of cultural and scientific diversity, captured through the management of information and knowledge in the career, by conceiving an adequate theoretical design and applying an intercultural research methodology.

PL-6. *Level of mastery of intercultural research:* observed in the correct use of a scientific methodology, consistent with intercultural pedagogy (Tapia, Reyes and Frómeta, 2020), when applying relevant research methods and techniques for the development of scientific tasks of the pre-professional practice linkage project.

Finally, the *university-educational units knowledge transfer phase* aims to evaluate the relevance and impact of the research solution proposed for the development of the educational units, based on the management of intercultural knowledge transfer associated with the solution between the university and the community located in educational units to which solutions to mathematical and physical problems are provided by means of software applications.

This phase has numerous actions designed to achieve the stated objective. In addition, it carries an evaluative criterion and achievement standards that are intended for teachers and students of the baccalaureate.

The achievement patterns for baccalaureate students in this phase are as follows:

PL-7. *Relevance and intercultural coherence of the scientific solution:* this is demonstrated when the proposed research solution succeeds in satisfying the various development needs of the actors of the educational units, adjusted to the conditions of the intercultural contexts, to the experiences and knowledge and to the existing scientific-research diversity.

PL-8. *Level of relevance of the research solution:* demonstrated by the intercultural solution proposed in the research project, in accordance with the beneficiaries, by promoting the intercultural educational development of multiple actors in the research context, educational units and, if possible, other contexts.

PL-9. *Level of effectiveness in intercultural scientific communication:* demonstrated in the efficiency and effectiveness of the intercultural scientific messages associated with the research solution, supported by different media to communicate the scientific results and findings of the linkage project.

Table 1 was used to evaluate the formation and development of intercultural investigative competence focused on the progress of the educational units. Once the Total Sum of the Scores (STP) was obtained, the following decision rule was used to establish the qualitative levels associated with this competence:

- If $STP \in [9; 23)$ \Rightarrow does not have formed intercultural research competence focused on the educational development of educational units, although some of its characteristic features may be exhibited.
- If $STP \in [23; 38)$ \Rightarrow has formed a basic level of intercultural research competence focused on the educational development of educational units.
- If $STP \in [38; 45]$ \Rightarrow has formed an advanced level of intercultural research competence focused on the educational development of educational units.

It should be noted that these achievement standards for university students should be evaluated from the frame of reference provided by the objectives and measurement criteria of the Program of Study of the degree program under study.

Table 1. *Patterns of achievement (PL) for PCEMF career students associated with intercultural research competence focused on educational development.*

No.	Patterns of achievement for students of the Pedagogy of Experimental Sciences of Mathematics and Physics.	RATING				
		1	2	3	4	5
PL 1.1	Level of assimilation of functional curriculum content					
PL 1.2	Level of training of professional pedagogical competences					
PL 1.3	Level of integration of curricular contents					
	Average grade of the integrative appropriation phase of the curricular content					
PL 2.1	Level of sensitivity and awareness of cross-cultural research.					
PL 2.2	Level of intercultural knowledge acquisition					
PL 2.3	Level of mastery of cross-cultural research					
	Average score of the practical linkage phase to the educational unit					

PL 3.1 Relevance and cross-cultural coherence of the scientific solution

PL 3.2 Level of relevance of the research solution

PL 3.3 Level of effectiveness in cross-cultural scientific communication

Average rating of the knowledge transfer phase university-teaching unit

Total sum of scores:

Estimation of intercultural research competence focused on the educational development of educational units.

Source: own elaboration.

MATERIALS AND METHODS

The study population consisted of 14 teachers and 100 students of the Pedagogy of Experimental Sciences of Mathematics and Physics during the year 2021. A sample of 65 students (two teaching groups of 32 and 33 students) and 12 university professors were selected from this population.

The research hypothesis that guided the present study was the following: the application of the pedagogical strategy of appropriation of the integrating content for the practical linkage and transfer of knowledge between the university and the educational units, favors the formation and development of intercultural investigative competence focused on academic performance.

During two consecutive semesters (April-October 2021), the selected group consisted of 33 students and six teachers. While the control group was structured by 32 students and six professors, in which the dynamics of the educational teaching process was developed in a traditional way, processes of information collection with digital support due to the measures imposed by Covid-19. The students were selected randomly.

The dependent variable (Y) was defined as: intercultural research competence focused on career development; and the independent variable (X) as: the pedagogical strategy of appropriation of the integrating content for the practical linkage and transfer of knowledge between the university and the educational units.

The logical link or relationship established between these variables was one of cause-effect, that is, the presence of the independent variable X implies the presence and increase of the dependent variable Y.

Variable X was operationalized in accordance with the three phases and actions that make up the pedagogical strategy of appropriation of the integrating content for the practical linkage and transfer of knowledge between the university and the educational unit for the development of academic performance. The variable Y, on the other hand, is a theoretical construct that is not directly observable in the pedagogical reality. Instead, to carry out the empirical evaluation of the research hypothesis, the dependent operational variable (y) was used: total sum of the scores assigned to the achievement patterns for university students, associated to the intercultural research competence focused on the educational development of the career, whose score ranges between 9 and 45 points, in correspondence with an ordinal scale, given that the rating of each achievement pattern was defined as: 5 (excellent), 4 (very good), 3 (good), 2 (regular) and 1 (bad). This variable integrates a system of indicators of an additive nature based on the achievement patterns that operationally reflect the Y variable, as shown in Table 1.

Then, the following operational hypothesis was defined: the application of the pedagogical strategy of appropriation of the integrating content for the practical linkage and transfer of knowledge between the university and the

educational units increases the total sum of the scores assigned to the achievement standards for university students, related to the intercultural investigative competence focused on the academic development of high school students.

In order to control, as far as possible, the sources of internal and external invalidation, these were analyzed in detail according to the suggestions of (Hernández, Fernández and Baptista, 1998). Although it was recognized that the greatest bias that could affect its internal validity would be the source associated with selection, since the control and experimental groups were already formed when it was decided to carry out the quasi-experiment and were not conceived by random assignment of their individuals.

The main stages of the methodology used to carry out the study are described below:

1. To prepare methodologically the six professors in charge of university teaching in the IV and V levels of the career in the experimental group, taking into account the conditions and requirements of its application and the assimilation of its application logic.
2. Prepare a new guide for students where they were provided with the necessary orientations to carry out the linkage project in the educational units, detailing the most important curricular contents to be taken into account, the activities that should be developed in each stage of this process during the IV and V levels of the career, as well as the objectives, evaluation criteria and achievement standards to be taken into account in each stage.
3. Supplying the independent variable X (the pedagogical strategy) to the experimental group. This was done keeping under control the sources of

internal and external invalidation identified in the pedagogical quasi-experiment. The supply of variable X in the experimental group, during the integrative appropriation phase of the curricular content, was carried out at level IV through the subjects: Physics III and Laboratory, Mathematics IV, General Pedagogy and General Didactics; and at level V through the subjects Physics IV and Laboratory, Mathematics V, and Research Methodology.

4. Subsequently, the second and third phases of the pedagogical strategy were continued. The experimental group was linked to the following educational units: María Auxiliadora, Margarita Cortez, Eloy Alfaro. It should be noted that the students of the experimental group were linked to educational units with similar characteristics: 5 de Agosto, Fausto Molina, Carlos Concha.
5. To evaluate the dependent variable and from the execution of the "Linkage Project with Educational Units" through the presentation and defense of the main results. Each student of the control group and the experimental group was evaluated the total sum of the scores assigned to the nine achievement standards, as an alternative to infer the level of formation of the intercultural research competence focused on the educational development of the career. The Consulting Group participated in these evaluations and also advised the six teachers of the control group in the evaluation of the achievement patterns of the pedagogical strategy.
6. Apply the Wilcoxon Signed Ranks and Matched Pairs Test (Siegel, 1972) to determine if there were significant differences in the dependent operative variable y, between the control group and the experimental group. This nonparametric statistical test was adjusted to the conditions

and requirements of the pedagogical quasi-experiment, since as there was no random assignment, selection bias could be reduced by the matching technique. Thus, 15 pairs of students as similar as possible were selected, one from the control group and one from the experimental group.

7. The criteria taken into account for the matching were the following: a) having a general academic index upon completion of the V level of the PCEMF course with a difference less than or equal to 0.2; having manifested an equivalent level of motivation towards intercultural scientific research, classified in the following levels: high, medium, low.

A significance level was prefixed at $\alpha = 0.05$ and the following statistical hypotheses were formulated:

Null hypothesis: the sum total of the scores assigned to the nine achievement patterns associated with the level of formation of intercultural investigative competence focused on the development of student performance in the PCEMF career, is lower or equal in the students of the experimental group than in the students of the control group.

Alternative hypothesis: the total sum of the scores assigned to the nine achievement patterns associated with the level of formation of intercultural investigative competence focused on the performance development of students in the PCEMF career, is higher in the students of the experimental group than in the students of the control group.

RESULTS

In the data collection process, following the methodology presented in the previous paragraphs, the results of the evaluation of the nine achievement patterns were obtained for the 15 pairs of students formed from the control group and the experimental group.

This comparison is shown by taking as a basis the mean value of the scores associated with each of the nine achievement patterns.

As can be seen, the mean value of the scores associated with the nine patterns of achievement was higher in the experimental group than in the control group, which shows the effectiveness of the pedagogical strategy applied, the comparison between the control group and the experimental group is presented, but in this case it is made with respect to the mean value of each phase of the strategy.

The average scores obtained in each phase of the strategy are also higher in the experimental group than in the control group, which shows the superiority of the application of the pedagogical strategy with respect to the traditional way of integrating the appropriation of the curricular content, the practical link to the career and the transfer of knowledge between the university and the educational units.

The comparison between the control group and the experimental group with respect to the levels of training and development of intercultural research competence focused on the educational development of educational units.

In the control group it was more frequent to form the basic level of the referred competence (80%) than in the experimental group (40%); while the advanced level of this competence, that is, its development, was more frequent to reach in the experimental group (60%) than in the control group (20%). It should be noted that none of the students who made up the 15 pairs presented an insufficient level of the competence under analysis.

The Wilcoxon Signed Ranks and Matched Pairs Test applied to determine whether there were significant differences in the dependent operating variable, between the control group and the experimental group, showed that the experimental probability was lower than the critical probability ($p \leq 0.05$), so the null hypothesis was rejected and the alternative hypothesis was accepted.

Therefore, it was concluded that, the sum total of the scores assigned to the nine achievement patterns associated with the level of intercultural research competence formation focused on the development of career performance is higher in the students of the experimental group than in those of the control group.

The acceptance of the alternative statistical hypothesis led to the acceptance of the operational hypothesis for the data obtained through the pedagogical quasi-experiment in the research context. Consequently, the validity of the research hypothesis of the present study was also accepted.

However, the Consulting Group identified the following qualitative transformations experienced by the university students in the experimental group:

Assimilation of the curricular content and its functional integration according to the tasks of the linkage project.

Recognition of the cultural and scientific diversity existing in the investigated context, showing an adequate level of intercultural sensitivity.

Selection of a satisfactory cross-cultural research logic for the development of research tasks.

Satisfactory interaction and integration to heterogeneous groups of the teaching unit in order to develop intercultural research tasks, showing commitment with the intercultural transformation and development of diverse actors.

Effective communication of cross-cultural results and findings encountered in developing the cross-cultural research task.

Management of pertinent and feasible research solutions, in correspondence with the available sources of information, the conditions of the intercultural contexts and the experiences and knowledge of its actors.

Assessment of the possibilities of generalizing the intercultural solutions provided in the linkage project, in order to manage intercultural development in various contexts.

It was evidenced that the proposed strategy can be used at the CPCEMF to improve the training and development of intercultural research competence focused on the educational development of the career and educational units, since its application made it possible to increase the number of students who achieved an advanced level in this competence.

There are several studies that have coincided in using the formation of research competencies as a way to integrate the knowledge, skills, attitudes, attitudes, skills and values that students should acquire during their process of linking with educational units (Tapia 2020; Tapia, Frómeta and Suárez 2020, Vera 2018; Castillejo, et al., 2017).

In Buendía, Zambrano and Alirio (2018), a lack of articulation between pedagogical practice and research in the context of pedagogical professional practice was detected. However, in the present study, an adequate articulation was detected in the students of the experimental group and a moderate relationship in the control group, which coincides with results reported by (Tapia 2020; and Pazmiño, Cortez and Maldonado (2019).

However, it should be noted that the results achieved in the present study have a high coincidence with those reported by Tapia (2020), in the sense of having used the same theoretical model but different practical instruments for its pedagogical implementation. In (Tapia, 2020), a pedagogical strategy was used, which emphasizes more on the intercultural aspect and focuses less on the transfer of knowledge between the university and the educational units.

Precisely, in the present study, the transfer of knowledge between the university and the educational units during the process of linkage that takes place in the pre-professional internships is studied in greater depth. It is

conceived that this transfer occurs both from the university to the educational units and from the educational units to the university. This implies recognizing that knowledge is generated in all community scenarios, which constitute valid learning sources for CPCEMF students and teachers.

CONCLUSIONS

The analysis of the current situation of the linkage process of the Pedagogy of Experimental Sciences of Mathematics and Physics Career with Educational Units of the education system, allowed revealing that the linkage process of the CPCEMF, with the educational units of the education system is energized by the development and formation of the Intercultural Investigative Competence, due to the pedagogical strategy used that allows perfecting the linkage process studied.

The pedagogical strategy of appropriation of the integrating content for the practical linkage and transfer of knowledge between the university and the educational units, was directed with the objective of guiding university professors and students of the Pedagogy Career of Experimental Sciences of Mathematics and Physics, on the pedagogical ways that should be carried out for the formation of the intercultural investigative competence focused on the performance of the students. The feasibility and relevance of the proposed pedagogical strategy was corroborated from the realization in the career under study, and from the observation, by the Consulting Group, of the different phases of the linkage process.

The application of the pedagogical strategy in the experimental group increased the level of intercultural investigative competence in students of the Pedagogy of Experimental Sciences of Mathematics and Physics, which was also associated with various qualitative transformations experienced by them. Therefore, it is considered that this strategy can be extensively applied in the

research context, in order to dynamize the linkage process between CPCEMF and the educational units measured by the development and intercultural research training of the students of the aforementioned career.

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