

Transdisciplinarity as a strategy for the enhancement of 21st-century skills associated with difficulties in real world-setting through project-based learning in a group of EFL learners from a B.A (program) of Physical Education (P.E.)

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Abstract

In the globalized and national contexts, the imperious necessity to respond quickly and reconsider current methodologies to learning throughout the educational industry and higher education institutions, in particular, becomes evident. The objective of this work was first, to analyze the correlation between English and the Physical Education of an undergraduate program at a higher-education institution in Bucaramanga in the curriculum using a transdisciplinary approach, determining that the transdisciplinary approach is an effective means of understanding the content of the information scheme by overcoming the limits of disciplinary division of knowledge. On the other hand, this study also contributes to the development and enhancement of 21st-century skills associated with difficulties in real-world settings through project-based learning among the participants. The results allow us to extract guidelines for the design of a transdisciplinary promotion policy that considers the challenges and the levels of complexity that we could identify.

Key words:

Transdisciplinarity, 21st century skills, PBL.

Introduction

Schooling in Colombia has always been a matter of controversy. Since its inception in the national context, as García-Duarte (2020) write “the academic instruction in public or private institutions has generated conflicts between the liberal and conservative political parties, and at the same time between the religious branch of the society and different civil state organizations, as and university education is not an exception” (p. 21-22). When it comes to looking back to the countrywide history, Universidad Santo Tomás (2017) states that “the Order of Preachers became a relevant protagonist in the higher educational system when serving as the intellectuals of the Catholic Church, compelled to study and teach.

Therefore, their primary concern was the foundation of educational institutions. Founded in 1580, Santo Tomás University is a non-profit private higher education institution located in the large metropolis of Bogotá” (p. 2) García-Duarte (2020) mentioned that “until the second half of the twentieth century, education—basic, middle, and university—was the stage in which the enlightened and confessional visions of nation-building were confronted. After this first half, the education in Colombia received an impulse as a public policy, representing a considerable amount in the national budget and modernizing not only the education itself in terms of undergraduate programs, but also in the way it is taught, allowing new methodologies and structural spaces take place in the 21st century modern world” (p. 22).

In recent years, local and global societies have faced several needs and challenges in 21st-century Education that have made everyone rethink the way students learn and teachers instruct. As Araque (2021) states modern society and the economy increasingly reward those organizations, products, processes, and people who can adjust, innovate, 3 and contribute to the global system, also, those oriented to problem-solving skills, critical-

thinking skills and other attitudes or behaviors with a mindset to respond to expectations from the society and the world. When dealing with university education, Rodriguez (2021) says that the sciences, departmental divisions, faculties, schools, among other subdivisions, remind us of the physical territoriality and the anchoring of power of some untouchable disciplines.

Therefore, McGregor (2015) suggests a transdisciplinary approach to solving real-world problems because transdisciplinarity is “more than interdisciplinarity (i.e., links between disciplines) in that it moves across and beyond disciplinary boundaries, transcending them to develop new experiences of learning related to real problems in real-world settings” (p. 80). Having said that, it is necessary to identify the correlation between English as a second language, and the Physical Education undergraduate program from Santo Tomás University sectional Bucaramanga in the curriculum. For this, students from 5th semester and their teacher are participants.

Considering this reality, we conducted the study reported here and addressed the following research question: How does transdisciplinarity as a strategy, evidence the development and enhancement of 21st-century skills associated with difficulties in real world-settings through project-based learning with a group of EFL learners from a B.A (program) of Physical Education?

Literature review

Transdisciplinarity: strengthening 21st century skills.

Historically, education has been divided into subjects and objects of investigation making the teacher owner of their territory where others are not welcomed unless there exists an obligated necessity. Educators have always planned their classes aside from other subjects of study and they meet with their “subject partners” to organize the scholar curriculum and they do not acknowledge what other disciplines teachers do to improve their students’ academic performance, and higher education is an example of this separation. “The mismatch between universities and the world is becoming broader and more complex. This is how, while the world has become increasingly globalized and interconnected, universities maintain curricular structures generated from fragmentation. The world was almost completely intercommunicated, but the higher education system is increasingly specialized” (García & Wilches, 2020, p. 180).

This is when transdisciplinarity takes relevance allowing the teamwork to go beyond siloed expertise and creating new perspectives, knowledge, and practice. Nicolescu (2007) states that transdisciplinarity is a cultural concept based on collaboration in knowledge, and on overcoming obstacles between scientific fields. Transdisciplinary knowledge becomes significant when talking on education and innovation strategies to make the academic instruction more meaningful to the students, to make it complete, like the human body where all the members are vital and necessary to each other, they are transversally connected to a beating heart that in this case is represented by the knowledge. As Jantsch (1999) mentioned, transdisciplinarity reflects a new space in which there are no stable boundaries among the disciplines.

In the World Conference on Higher Education, assembled at UNESCO Headquarters in Paris, it was said that “higher education should reinforce its role of service to society” (1998), to encourage transdisciplinarity of educational process programs and to teach future professionals, using transdisciplinary approach to solve complex problems of nature and society, to offer a possible solution regarding a specific 21st century issue.

Research has demonstrated that, transdisciplinarity can lead to significant changes, in the epistemic field to learn to think complex reality through new tools, namely, transdisciplinary pillars and complex principles (Morín, 2005; Nicolescu, 1998, as cited in Rodríguez 2021), encouraging us to leave the position of power in teaching, without abandoning the disciplines, because without them there is no transdisciplinarity.

21st century skills: Scope, needs, challenges, and implications

The acceleration in technology development, the digitalization of the world economy, and the new working alternatives that emerged as a consequence of the COVID-19 pandemic have increased the demand of people with the necessary abilities to rapidly adapt to changes and contribute to the global development through the implementation of a mindset based on a series of abilities. These abilities are expected to last for a lifetime as Xomaqui (2019) states: “In order to ensure individuals’ resilience and ability to adapt to social, economic and other forms of change, they must learn how to learn” (p. 24). According to Lebid et al. (2021), educational programs must expand the methods of training professionals so that they can keep up with the demands of the contemporary labor market.

Agency is a crucial aspect in the development of 21-century skills. It refers to the ability to shape one's life and influence on the lives of others. This implies changes in the curriculum to place learners at the center of the process and recognize their value and abilities as well as the others' (Araque, 2021). Xomaqui (2019) mentions that to foster participation in civic life both locally and globally it is important to promote the understanding and respect of diverse social and cultural groups.

Araque (2021) writes: "Experts and associations have been looking to synthesize or outline what it takes to succeed in the 21st-century; in the end, they all agree that technology is one key component and a necessary place to start" (p. 23). On the other hand, Lebid et al. (2021) state: "Experts and associations have been looking to synthesize or outline what it takes to succeed in the 21st-century; in the end, they all agree that technology is one key component and a necessary place to start" (p. 970). These two arguments highlight the importance of the implementation of technology in the promotion of 21-century skills.

There is a set of skills that experts consider necessary to enable personal and organizational growth. They are leadership, cross-cultural skills and the four C's (critical thinking, creativity, collaboration, and communication). 21st Century Classroom (2019) goes deeper into understanding each one of them. Critical thinking refers to the ability to analyze an everyday problem and provide a solution on one's initiative. Creativity is thinking out of the box and proposing innovative ideas. Collaboration consists of working together to achieve a common goal. Communication is about conveying your ideas quickly and concisely.

Project based learning: Characteristics and implications.

Project based learning is considered a teaching method which focuses on the assignment of group tasks, where the aim is to obtain a final resource. Balanescu (2015) manifested “...it implied replacing the classical study subjects with the performance of practical activities, having a real purpose (learning-by-doing), starting from the Pupils’ spontaneous interests” (p. 1), and according to what was mentioned before, when applying this specific method, it breaks the traditional teaching methodologies, which were focused on the teacher as the center of the class, and students start to be the main objective of the teaching process.

Klyoster et al (2018) established a series of elements to carry out a project-based learning process “active mental and physical activity of students, self-organization and responsibility for their activities, combined with their personal interest, the use of different methods of cooperative learning, that is, the ability to work in a team” (p. 3), and as it was seen before, the collective work is fundamental when developing this method. They added that project-based learning also requires an interdisciplinary knowledge, because of the combination of theoretical knowledge and practical application, and this contributes to the solution of specific problems.

In addition, project-based learning contains a series of steps to carry out it properly.

Klyoster et al (2018) proposed the following steps:

“1. Planning. At the planning stage, information sources and evaluation criteria are identified, and tasks are assigned to the project participants. 2. Conducting research. The research itself presupposes the collection of information and the solution of intermediate

tasks, followed by a stage of analysis and generalization of information with the formulation of results and conclusions. 3. Conclusion. The final stage of the project activity is the report and presentation of the project itself with a possible prospect of implementing the results. (p. 3).

On the other hand, Balanescu (2015) posed a different series of steps to develop it, they are the next ones:

1. Identifying an issue/topic/subject; 2. Collecting, organizing, processing and evaluating the information related to the chosen issue or topic; 3. Elaborating a set of possible solutions to the issue; 4. Evaluating the solutions and deciding on the best choice; 5. * (optionally) applying the solution opted for, which implies elaborating an implementation plan, with stages, resources, responsibilities, manners of evaluating the obtained results. (p. 3).

Nowadays, when technology is used as a resource in project-based learning, it is focused on their interests to be able to acquire new knowledge. Klyoster et al (2018) described that “project-based learning in the educational process implies that students understand and apply the knowledge, abilities, and skills that they acquired in studying various subjects on an integrative basis” (p. 3), and this is why they will give some possible solutions to different issues that they will face when working on this method, and it would be necessary to have some previous abilities or skills to carry out an appropriate process.

Also, they added some required features when applying it to educational contexts. Klyoster et al (2018) integrated characteristics to build a correct process based on the teaching method previously mentioned, a dominant activity, content of subject activity,

project coordination, level of project implementation, number of participants, and execution time.

Research Design

Method

This research project was developed by means of a qualitative approach; this approach helps to collect information based on the issue previously identified and the analysis of what was found inside of the results from the participants, that is the identification of the meaning in their findings. An exploratory case study within a pedagogical plan frame that integrated transdisciplinary and the enhancement of 21st century skills through PBL was chosen. A qualitative approach allows us not to interpret the results by accounting or enumerable evidence, but the comprehension of particular situations presented in the context when living the experience of developing the research. Yin (2018) emphasizes the value of exploratory case studies in educational research highlighting how case studies allow researchers to investigate real-life situations and phenomena in depth, providing rich insights into complex educational contexts.

Context is composed by a private catholic Colombian university located in Bucaramanga, but it contains different sectionals in Bogotá, Medellín, Tunja and Villavicencio. The infrastructure of the university has varied spaces such as libraries, welfare offices, university canteens, multi-purpose courts, coliseum, swimming pool, offices, a parking lot, and enchanting green areas. In terms of ITCs, all the sectional campus has high-quality internet connection, as well as computer and technology rooms, projectors, and air conditioning in each classroom. The emphasis of the university is to

promote the integral formation of people in the field of higher education, through actions and processes of teaching, learning, research, and social projection, so they respond in an ethical, creative, and critical way to the demands of human life and are in a position to provide solutions to the problems and needs of society.

Instruments

In order to achieve the specific objectives of this research, six instruments to collect data were implemented. Firstly, to design a transdisciplinarity strategy through PBL for the enhancement of 21st-century skills associated with difficulties in real world-setting difficulties through project-based learning in a group of EFL learners from a B.A (program) of P.E. a diagnostic test was applied. The diagnostic test <https://rb.gy/mowqw> is designed to locate specific learning deficiencies in case of specific individuals at a specific stage of learning so that specific efforts could be made to overcome those deficiencies (Kumar, 2016).

Secondly, to describe the results of the implementation of transdisciplinarity as a strategy for the enhancement of 21st century skills in relation to real world-setting difficulties, a number of 6 lessons with the pedagogical inputs <https://rb.gy/e0uo5> were designed and implemented. By the end of the lessons, participants created an artifact <https://rb.gy/ex0fi> and took a posttest <https://rb.gy/igzxy>. According to Malik (2019), the post-test design is an important assessment instrument that helps in direct and effective evaluation of a course or lecture to improve student learning.

Finally, an online questionnaire <https://forms.gle/nY9CesJeuHdVyBGa7> and a semi-structured interview in Spanish <https://rb.gy/76ay8> were carried out to analyze the EFL learners' perceptions from a B.A program of Physical Education regarding the implementation of a transdisciplinarity strategy through PBL and the enhancement of 21st-century skills. Moreover, “interviews are a classic way in research to conduct a conversation that explores your focus area” (Burns, 2009, p.74). Yuni and Urbano (2014) argue that incorporating technology in interviews provides individuals with the opportunity to express their experiences, sensations, and ideas.

At this point, it is relevant to mention that participant observation was present across the project when implementing the data collection instruments. Creswell (2014), emphasizes the importance of observation as a valuable tool for collecting data in qualitative research and highlights the ability to provide in-depth understanding and insights into the researched phenomena.

Participants:

This study explored a group of students from 18 to 24 years old from different cities or municipalities in Santander, Colombia. These students belong to the Physical Education undergraduate program between fourth and fifth semester. When it comes to time studying, it is mandatory for the students to take 6 semesters or 3 years of English in all the university programs at this institution. One researcher played a passive role as an observer due to his location and the other 2 were directly involved in the institution.

Table 1

Participants, Place of Birth, Bachelor Program, Age

Participants	Place of Birth	Bachelor Program	Age
St. # 1	Bucaramanga	Cultura Física Recreación y Deporte	18
St. # 2	Bucaramanga	Cultura Física Recreación y Deporte	19
St. # 3	Bucaramanga	Cultura Física Recreación y Deporte	19
St. # 4	Bucaramanga	Cultura Física Recreación y Deporte	20
St. # 5	Bucaramanga	Cultura Física Recreación y Deporte	20
St. # 6	Bucaramanga	Cultura Física Recreación y Deporte	21
St. # 7	Bucaramanga	Cultura Física Recreación y Deporte	21
St. # 8	Bucaramanga	Cultura Física Recreación y Deporte	20
St. # 9	Bucaramanga	Cultura Física Recreación y Deporte	19
St. # 10	Cimitarra	Cultura Física Recreación y Deporte	22
St. # 11	Floridablanca	Cultura Física Recreación y Deporte	22
St. # 12	Floridablanca	Cultura Física Recreación y Deporte	24
St. # 13	Onzaga	Cultura Física Recreación y Deporte	23
St. # 14	Piedecuesta	Cultura Física Recreación y Deporte	22
St. # 15	Piedecuesta	Cultura Física Recreación y Deporte	21
St. # 16	San Vicente de Chucurí	Cultura Física Recreación y Deporte	23

Analysis and Findings

The project's main objective is to establish the development of transdisciplinarity as a strategy for the enhancement of 21st-century skills associated with difficulties in real world-setting through project-based learning in a group of EFL learners from a B.A (program) of Physical Education (P.E.). Denzin (2017), stresses the importance of qualitative inquiry in capturing the complexity and depth of educational phenomena. He argues that qualitative research methods allow researchers to understand the meaning and context of educational experiences, making it a suitable approach for investigating the development of skills in real-world settings.

Data collection involved a period of 3 months. During this time the 3 researchers were looking for evidence to observe in the participants group. One researcher played the role of observer at a distance because of his geographical location and the other two were observers directly involved in the academic institution. Eighteen students involved in the project were invited to participate in the data collection process. Their academic and professional experiences and the impact of these know-how were taken into consideration. Sixteen participants willingly provided their informed consent to participate in the study.

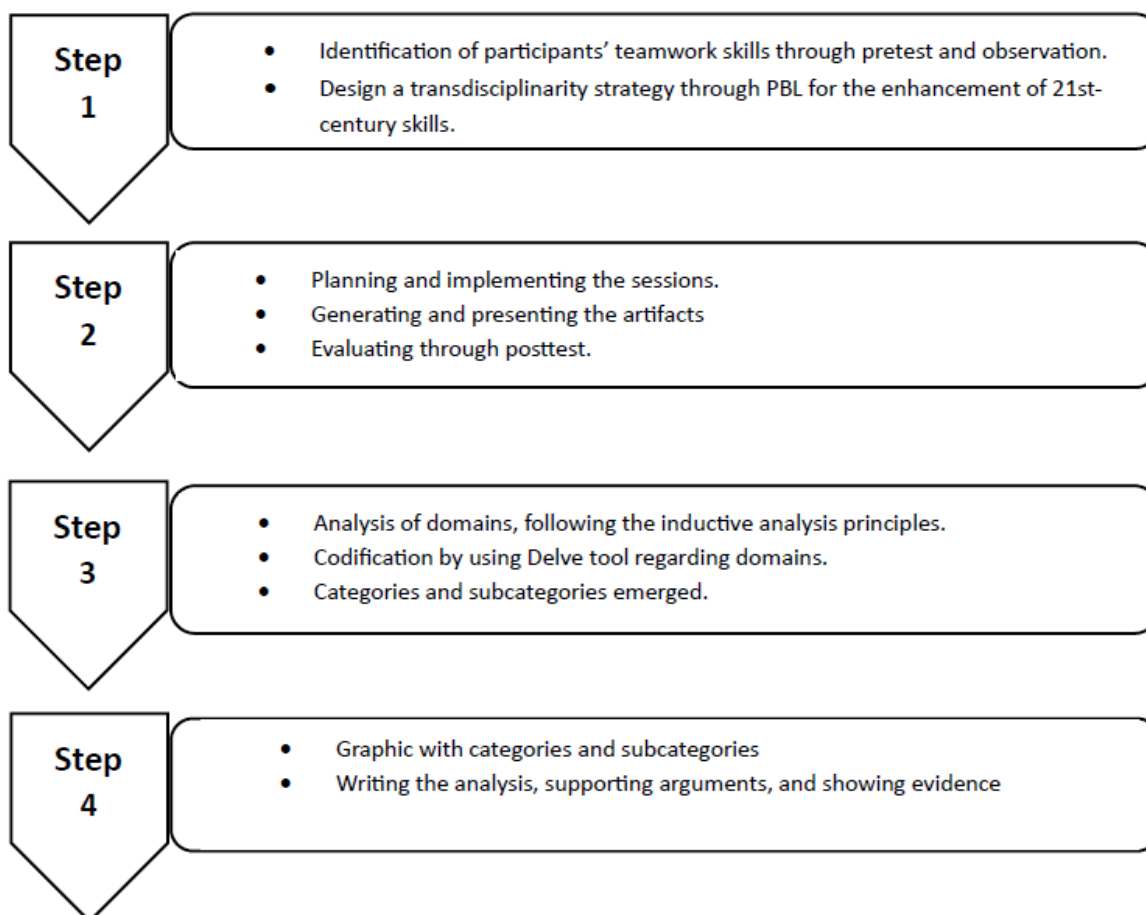
The principles of inductive data analysis approach supported the process of analysis of data collected in this project. Charmaz (2006), emphasizes the importance of coding, constant comparison, and the emergence of themes from the data. Moreover Creswell (2013), highlights the importance of allowing themes and patterns to emerge from the data and advocates for an inductive reasoning process in qualitative data analysis.

In the initial stage of the inductive analysis, the collected data was carefully reviewed and analyzed to identify key patterns and themes. This process involved creating

analytical frameworks and assigning relevant codes to the data. Subsequently, a process of abstraction was employed to condense the extensive information by grouping related data together, allowing for the emergence of meaningful subcategories. Through this iterative process, the research question was addressed and findings were organized into distinct categories and subcategories. Strauss and Corbin (1998), state that categories are constructed through the process of coding, in which data is systematically analyzed and assigned to specific categories based on its relevance and meaning.

Figure 1

Steps for data analysis



Six data collection methods were used for this study: a pre-test, lesson plans, students' artifacts, a posttest, a Spanish oral interview, and an online questionnaire. In the first step of our research, we aimed to identify the teamwork level of the participants through a pretest and immediate observation. This allowed us to establish a baseline understanding of their existing knowledge and skills related to critical thinking, problem-solving contexts, teamwork abilities and the main categories of the investigation. To enhance 21st-century skills, we designed a transdisciplinary strategy using Project-Based Learning (PBL) as our instructional approach. According to Hmelo-Silver et al. (2007), PBL is an instructional method that engages students in real-world problem-solving activities, promoting critical thinking, collaboration, and creativity. By incorporating PBL into our approach, we aimed to create an authentic learning experience that would foster the development of 21st-century skills, such as communication, problem-solving, and teamwork.

In the second step, we focused on planning and implementing the PBL sessions. We carefully designed the learning activities and the pedagogical materials, identified suitable problems or scenarios, and structured the sessions to facilitate active engagement and collaboration among participants. The participants were provided with the necessary resources and guidance to generate artifacts that would demonstrate their understanding and problem-solving approaches.

Table 2

Description of the lessons

Number of lesson	Description
Lesson 1	Students learned key vocabulary related to sports injuries and practiced it through online games and role-play scenarios, enhancing their language skills and subject understanding.
Lesson 2	Students explored the first conditional in the context of sports injuries, deepening their grammatical understanding and applying it through exercises and conversations.
Lesson 3	Students began the project work, conducting research on selected injuries, and receiving guidelines and an example for the project, fostering research and planning skills.
Lesson 4	Students developed a six-step program for preventing and treating their chosen injury and started designing their infographic, applying their knowledge and digital literacy skills.
Lesson 5	Students prepared and rehearsed their oral presentations and participated in a feedforward session, enhancing their presentation skills and ability to give and receive constructive feedback.
Lesson 6	Students presented their final project, engaged in peer feedback, and reflected on the applicability of the project to their professional development.

Note: This table shows a summary of the lesson plans; to see the the complete planning, click on the link: <https://rb.gy/lb8r9>

During the sessions, participants had the opportunity to work individually or in groups, conducting research, analyzing data, and generating solutions to the presented contexts. The artifacts created by the participants served as tangible evidence of their learning and problem-solving processes. These artifacts included outlines, infographics and presentations that showcased their understanding and application of the subject matter. To conclude this second step, the researchers implemented a posttest based on the grammar

pattern and semantics the participants had been instructed to , to evaluate the grammatical and vocabulary learning students' outputs.

Figure 2

Students' artifacts



Note: This figure shows an example of a student's artifact; to see the students' artifacts click on the link: <https://rb.gy/iy7lw>

In the third step, we focused on analyzing the domains within the collected data. Following the principles of inductive analysis, we conducted a thorough examination of the artifacts, interviews, posttests and observations to identify common themes, patterns, and emerging subcategories. For the analysis we used the content analysis methodology. It allowed us in organizing and categorizing the data according to the identified domains, facilitating a systematic and efficient analysis process. This approach allowed us to derive meaningful insights and uncover the underlying connections and relationships between different categories and subcategories. Drawing on the work of Saldaña (2016), we ensured that our analysis adhered to the principles of inductive analysis, which involves allowing patterns and categories to emerge directly from the data rather than imposing preconceived notions or theories onto the analysis. This approach facilitated a grounded understanding of the participants' experiences, perspectives, and the development of 21st-century skills through the transdisciplinary PBL strategy.

In the final step, we created a graphic representation that visually depicted the identified categories and subcategories derived from the analysis. This graphic aided in presenting a comprehensive overview of the key themes and relationships found within the data. Subsequently, we proceeded to write the analysis section, where we provided a detailed interpretation of the findings. The analysis involved supporting our arguments with relevant evidence and references to the participants' artifacts, interview excerpts, and other data sources. This allowed us to substantiate our claims and provide a comprehensive understanding of the impact of the transdisciplinary PBL strategy on the enhancement of

21st-century skills. By referencing the work of Creswell (2013), we ensured a rigorous and systematic approach to the analysis and interpretation of the data. We presented a cohesive narrative that reflected the participants' experiences, highlighting the effectiveness of the transdisciplinary PBL approach in fostering the development of 21st-century skills.

In order to start writing the narrative of the research process, the analysis of the pretest to identify the participants' teamwork skills results was made <https://rb.gy/bdx6p>, and two graphics were created, the first one clarifies the categories, the emerging subcategories and codes (see Figure 5) and the second graphic supports this information with excerpts taken from data collection instruments (see Table 5)

Upon identification of the domains, discernible connections and interrelationships among them were duly acknowledged. Through a meticulous analysis, five distinct subcategories surfaced, providing a means to effectively group the identified domains. Subsequently, these subcategories were systematically organized into three overarching main categories, specifically denoted as Transdisciplinarity, PBL (Problem-Based Learning), and 21st Century skills. The categories presented discernible facets that exhibited significance across various stages of the research endeavor, including the pretest, pedagogical implementation, posttest, online questionnaire, and interview. Consequently, these findings offered valuable insights to address the research question at hand.

Figure 3

Research categories and subcategories

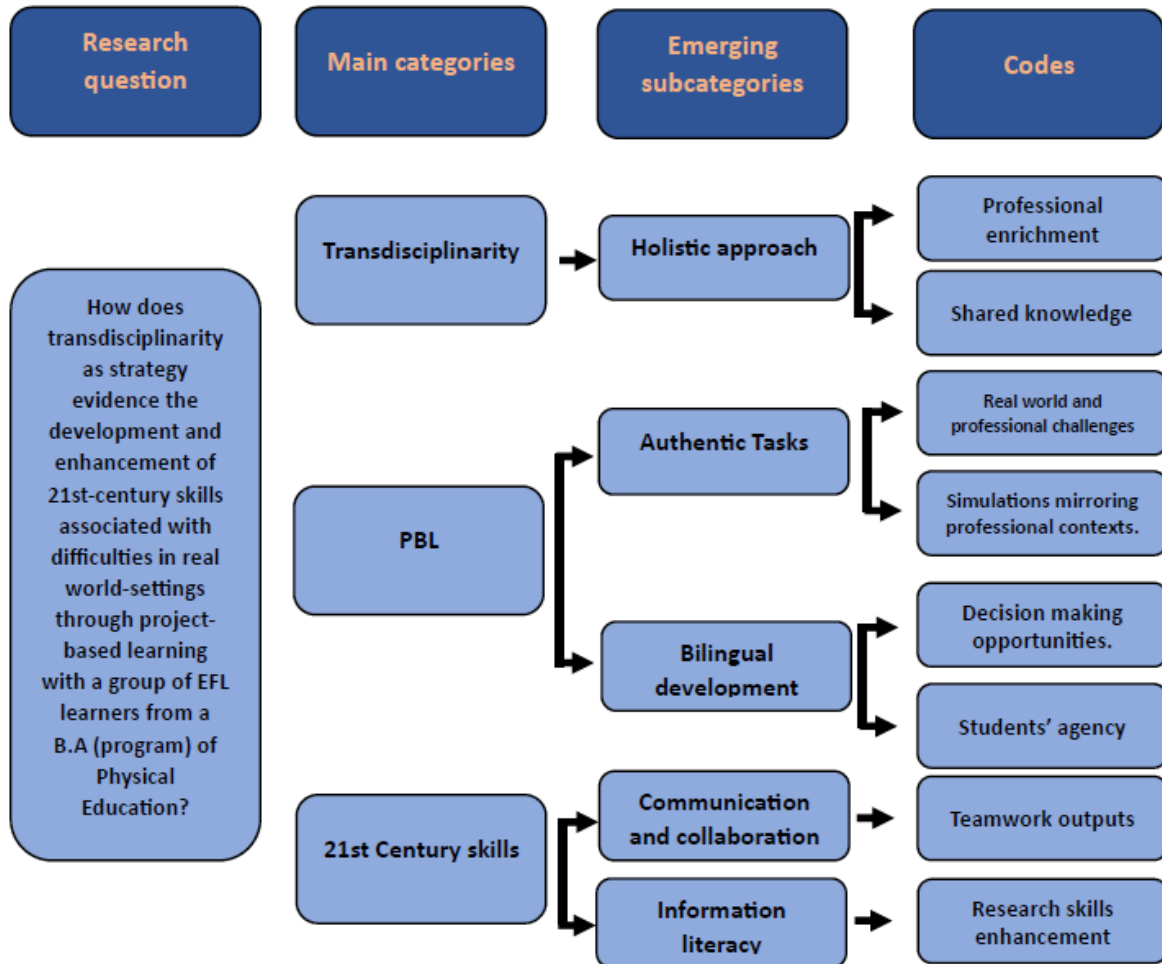


Table 3

Research categories, subcategories and excerpts

Main Categories	Sub Categories	Codes	Sample excerpts
Transdisciplinarity	Holistic approach	Professional enrichment	"no solamente, pues en la vida cotidiana, sino enfocar nuestra carrera, para así tener más oportunidades a nivel laboral o simplemente también personal". (Interview 3, St. 3)
		Shared	"Y, me siento que me benefició del proyecto a nivel profesional, puesto que simplemente no, no sólo estudio por estudiar, sino realmente para aprender y la vida cotidiana, tanto en la vida como profesional, como normal, pues siento que estos esto sea implementar". (Interview 3, St. 3)
			"Sí, claro que sí. La relación que encontré entre las



knowledge dos es muy interesante, ya que desde un punto morfológico me permitió conocer las partes del cuerpo, los músculos y etcétera. El uso que yo le podría dar a implementar sería, por ejemplo, en los últimos semestres de mi carrera, hacer un intercambio en el cual, por ejemplo, podría ser Estados Unidos y de esta manera puedes empezar a trabajar allá como entrenador personal y para utilizar ese término esos serbios.” (Interview 1, St. 1) “Al cual también les permitió, por ejemplo, devolverse en trabajos morfológicos de la materia de morfología y fisiología dentro de nuestra facultad”. (Interview 1, St. 1)			
PBL	Authentic tasks	Real world challenges	“Y en el diario vivir, tanto en el trabajo o en las actividades diarias de que uno pueda tener, es importante pues comunicarse del saber qué hacer también es muy fundamental este tipo de proyectos para para nuestra educación”. (Interview 3, St. 3) “Bueno, a través de proyectos como estos, sobre la diversidad de temáticas de nuestro entorno de la carrera, implementarlos ya no sólo en el tema de enfermedades o lesiones, sino el hecho de diario vivir en las diferentes poblaciones ya bien sea, en niños, jóvenes o adultos mayores”. (Interview 4, St. 4)
		Simulations mirroring professional contexts	“Como bien sabemos, somos este somos propensos a encontrarnos con trabajos que tengan una segunda lengua y pues sería muy bueno que desde el progreso del pregrado empezamos ya a tener este tipo de contactos como bien, como bien he dicho con vocabulario y fluidez del idioma”. (Interview 5, St. 5) “Bueno mi diario vivir lo implementaría en lo que trabajo que es en una Academia de fútbol, entonces ya tendría un poquito más, de claro sobre la lesión y sobre las lesiones que los compañeros explicaron. Entonces podría aplicar ese conocimiento en la Academia, sea un golpe con un niño o un golpe del equipo rival. Entonces aplicar ese conocimiento previo que obtuve en las ponencias para así poder hacer una buena ejecución en mi trabajo”. (Interview 5, St. 5)
Bilingual development	Decision making opportunities		“Puesto que esto pues nos ayuda, nos invitó a tener poco más de lectura y también de aprendizaje sobre la lesión o el tema escogido”. (Interview 2, St. 2) “Bueno propio conocimiento que pudimos implementar bien el tema que yo escogí ya sabía de qué se trataba”. (Interview 5, St. 5)
	Students’ agency		“al hacer varios proyectos y trabajarlos personalmente, me ha permitido desenvolverse de



campos que no sabía que podía”. (Interview 1, St. 1)

“Básicamente, yo siempre he sido el tipo de estudiante en el que el inglés siempre me ha costado demasiado pero gracias a este proyecto, después de decir que he aprendido muchas nociones básicas y ya me he podido desenvolver muchísimo mejor en esta materia.”(Interview 1, St. 1)

21st Century Skills	Communication and collaboration	Teamwork	"Como es sabido en la cultura física, mayormente nunca se ve un solo individuo, sino siempre hay más de una sola persona trabajando en diferentes áreas. Por ejemplo, en un equipo de fútbol no únicamente está el entrenador, está el fisioterapeuta, entrenador, el metodólogo en donde todas las posiciones son importantes, entonces por lo tanto el trabajo en equipo y la cooperación es en los proyectos son severamente importantes para el funcionamiento correcto de todo un equipo". (Interview 1, St. 1) “Y a la hora de la verdad, pues pueden haber muchos puntos de vista diferentes, pero siempre si se trabaja constructivamente pueden llegar a un punto en común.” (Interview 4, St. 4)
	Information literacy	Research skills	"Creo que pues el proyecto favoreció el desarrollo de nosotros, el tanto de la pensamiento crítico de la creatividad en el tema de cómo buscar maneras para para el aprendizaje que sea mucho más fácil, mucho más rápido y que sea más efectivo". (Interview 3, St. 3) “Bueno, las características del proyecto que nos beneficiaron en nuestra Formación Profesional es la fluidez el hecho de aprender un poco más de la literatura en sí, de una literatura que nos importa cómo es el deporte para saber, para futuras investigaciones, para saber trabajar”. (Interview 5, St. 5)

Transdisciplinarity

According to the findings, three main categories emerged to answer the research question of this study (see Table 3). This session addresses the analysis of the first main category named *Transdisciplinarity*, and the only emerging subcategory: *Holistic approach*.

The subcategory of this analysis describes a *Holistic approach* in which the participants of the higher academic institution were involved. Miller and Seller (1985) argue that “a holistic approach to learning considers the whole person and their integral experience, including cognitive, emotional, physical, and spiritual aspects”. Consequently, two codes stated as *professional enrichment* and *shared knowledge*, emerged from this subcategory, and became evident in the research development.

The participants manifested that the *professional enhancement* was remarkably improved taking into account the research dynamic due to what they were able to do in terms of using the proper terminology when speaking on the body parts, muscles, joints, injuries, among others, related to their undergraduate program and sports practices. The following excerpt clearly shows the reflection of one of the members of the project: “Y, me siento que me benefició del proyecto a nivel profesional, puesto que simplemente no, no sólo estudio por estudiar, sino realmente para aprender y la vida cotidiana, tanto en la vida como profesional, como normal, pues siento que estos esto sea implementar”. (Interview 3, St. 3)

It highlights the relevance of the academic project implementation taking into account the transdisciplinarity as a main connecting category in the pedagogical project

making their studying practices more practical and engaging to their future professional experiences and opportunities, as stated by (Interview 3, St. 3) when said: “para así tener más oportunidades a nivel laboral o simplemente también personal”

Quoting Nicolescu (2007) when establishing that transdisciplinarity is a cultural concept based on collaboration in knowledge, the second code named *shared knowledge* plays a significant role in the investigation development and the implementation of the pedagogical practice, not only for the students but also for the researcher teachers, since they had to rethink and redesign the lessons in the expected contents to be covered during one the terms of the semester. The following part from one of the interviews remarks the importance of the transdisciplinarity collaboration: "Durante este proyecto encontré una gran relación entre, pues el aprendizaje del inglés, incluido también con el aprendizaje de otros componentes de la carrera"(Interview 2, St. 2). As researchers, it is a must to say that integrating transdisciplinarity between English and Physical Education enhanced the academic process for students by combining language skills with practical and physical contexts. This approach fostered holistic development, promoting cognitive, social, and physical growth. Students engaged in sports and physical activities while communicating, collaborating, and expressing themselves in English, making language learning dynamic and purposeful. The integration of these disciplines nurtured creativity, critical thinking, and problem-solving abilities, bridging the gap between linguistic and kinesthetic learning.

PBL

In this qualitative research project conducted with undergraduate physical education students, the data analysis revealed the emergence of the subcategory "*Authentic tasks*" within the larger category of *Project-Based Learning* (PBL). The authentic tasks subcategory, involved real-world problems that were relevant to the learners' lives, simulating the tasks of professionals in practice as Lombardi concluded(2007). This subcategory encompassed two codes: "*Real world and professional challenges*" and "*Simulations mirroring professional contexts.*"

The first code, "*Real world and professional challenges,*" reflected the students' engagement in tasks and projects that mirrored real-life situations and professional challenges encountered within the field of physical education and different sports practices. Kolb (2014) argued that “engagement with real-world challenges facilitates deeper learning and bridges the gap between theory and practice”. This code captured instances where students were confronted with practical problems and scenarios that required them to apply their knowledge, skills, and critical thinking abilities to address authentic challenges when providing ideas based on academic knowledge to prevent and act in case of injuries that may appear on sportive practices.

The "*Simulations mirroring professional contexts*" code, encompassed situations in which students participated in simulated activities or scenarios that closely resembled real-world professional contexts in the field of physical education, as Aldrich (2009) stated that "simulations that mirror professional contexts provide immersive learning experiences,

enabling learners to practice skills in a safe environment" The following excerpt confirms what researchers found when collecting and analyzing the data: "Bueno mi diario vivir lo implementaría en lo que trabajo que es en una Academia de fútbol, entonces ya tendría un poquito más, de claro sobre la lesión y sobre las lesiones que los compañeros explicaron. Entonces podría aplicar ese conocimiento en la Academia, sea un golpe con un niño o un golpe del equipo rival" (Interview 5, St. 5). These simulations aimed to provide students with practical experiences and exposure to the types of situations they would encounter in their future careers. Through these simulations, students had the opportunity to apply their theoretical knowledge, develop professional skills, and gain a deeper understanding of the complexities of their chosen profession.

The analysis of the findings within the "Authentic tasks" subcategory highlighted the significance of providing students with opportunities to engage in real-world and professional challenges as well as simulations that mirror professional contexts. These experiences are valuable in preparing students for the demands and realities of their future careers in physical education. By engaging in authentic tasks and simulations, students can develop the necessary skills, problem-solving abilities, and confidence to effectively navigate professional challenges and contribute meaningfully to the field.

The ongoing analysis under the PBL category, allowed the emergence of the subcategory "*Bilingual development*". This subcategory embraced other two codes: "*Decision making opportunities*" and "*Student agency*."

The "*decision making opportunities* code," highlighted several chances where students engaged in PBL activities that required them to make decisions and choices not only related to their bilingual development, but also regarding the sport or physical activity

they wanted to focus on. This code captured situations where participants had the autonomy to select language strategies, make language-related decisions, and exercise their judgment in using bilingual skills effectively within the context of physical education. These decision-making opportunities empowered students to take ownership of their language learning process, as Paul & Elder (2006) established when they said that moments to make decisions in authentic and real contexts enhance critical thinking and problem-solving skills in the research partakers.

According to Zimmerman, (2002), "Student agency refers to the degree of control and autonomy learners have over their own education, which is crucial for motivation and self-regulation" This second code, reflected the students' active involvement and control over their own bilingual development within the PBL context, allowing students demonstrated agency by actively engaging in tasks, taking initiative, and assuming responsibility for their language and professional growth. Students had the freedom to express themselves, make choices, and actively shape their bilingual competencies, fostering a sense of ownership and motivation in their learning journey.

The detailed investigation of the data within the "Bilingual development" subcategory underscored the significance of providing decision-making opportunities and promoting student agency in fostering effective bilingual development within the PBL framework. By incorporating decision-making elements, students were able to exercise their language skills in meaningful and authentic ways, leading to a deeper understanding and application of bilingualism in the context of their academic undergraduate program. The promotion of student agency further enhanced their sense of responsibility and

motivation, allowing them to actively drive their own language learning process and positively contribute to their bilingual development.

21st Century skills

In the category of "*21st-century skills*", two emerging subcategories called "*Communication and collaboration*" and "*Information literacy*" were identified. This first subcategory included one specific code titled "*teamwork outputs*."

The code "teamwork outputs" as Levi (2017) affirmed: "effective teamwork yields outputs that are greater than the sum of individual efforts, fostering creativity, learning, and productivity", evidenced several opportunities where students demonstrated effective communication and collaboration skills within team-based activities. It allowed the researchers to corroborate the information gathered in the pretest in which the cooperation and partnership were palpable when working together towards a common goal, making decisions and creating their artifacts. These outputs included successful coordination, effective communication, and the ability to collaborate harmoniously as a team to achieve the desired outcomes.

The finding analysis within the "*communication and collaboration*" subcategory emphasized the significance of developing teamwork outputs as part of fostering 21st-century skills among physical education students. The ability to effectively communicate and collaborate with peers is essential in the modern era, as it cultivates interpersonal skills, cooperation, and synergy in achieving shared objectives. By engaging in team-based activities, students had opportunities to enhance their communication skills, actively listen to others, express ideas clearly, and engage in constructive dialogue.

The identification of the "teamwork outputs" code highlighted the importance of promoting communication and collaboration skills within the context of physical education. By developing these skills, students were not only equipped for success in the modern world but also prepared for future professional environments that require effective teamwork and cooperation, as it was stated by Interview 4, St. 4: “y a la hora de la verdad, pues pueden haber muchos puntos de vista diferentes, pero siempre si se trabaja constructivamente pueden llegar a un punto en común.”

Lastly, the findings of the subcategory “*Information literacy*”, included one specific code titled “*Research skills enhancement*.” This last code reinforced occasions where students demonstrated improved abilities in conducting research, gathering relevant information, and critically evaluating sources within the field of their academic program. The participants had to look for technical and specific names regarding the body anatomy and physiology connected to injuries and illnesses when practicing a sport.

The ability to access, evaluate, and utilize information effectively was crucial for students to make informed decisions, engage in evidence-based practices, and stay updated with advancements in their field, just like Head & Eisenberg (2010) confirmed when they said that engaging students in research tasks improves their ability to surf the internet, evaluate, and effectively use information.

The identification of the "Research skills enhancement" code highlighted the importance of information literacy within the context of physical education. By developing these skills, students were not only prepared for the demands of the 21st century but also empowered to contribute to the field through evidence-based practices and scholarly engagement, fostering a mindset of lifelong learning, as students were equipped to

continuously seek, evaluate, and apply new information to their professional growth in the physical education areas.

To conclude, the integration of transdisciplinary approaches, where different disciplines intersect and collaborate, enables students to tackle complex challenges that mirror real-world settings. By combining the principles of transdisciplinarity and PBL, EFL learners in the Physical Education program can develop a deep understanding of their field while gaining valuable transferable skills that will prepare them for future academic and professional endeavors. It implies a sense of responsibility to participate in the world and, in doing so, influence others to modify circumstances or situations for the better (Araque, 2021).



Conclusions

This research project has yielded significant insights into the effectiveness of a transdisciplinary approach and Project-Based Learning (PBL) within a bilingual learning environment, particularly in the context of a physical education undergraduate program. These pedagogical strategies have shown to not only enhance English language proficiency among students but also facilitate the acquisition of crucial 21st-century skills such as communication, collaboration, and information literacy.

The results respond to the initial research question and align with the specific objectives of the project, emphasizing the power of holistic learning experiences that unite cognitive, emotional, physical, and spiritual aspects (Miller & Seller, 1985). Furthermore, our work as researchers within the Master's Program in Bilingual Learning Environments (MABA) has been reinforced, underlining the significance of advancing knowledge in these areas.

Engagement with real-world problems through PBL, and the creation of authentic tasks have proven effective in fostering critical thinking, decision-making abilities, and promoting student agency (Paul & Elder, 2006; Zimmerman, 2002). Moreover, these strategies have enriched students' professional development and amplified their shared knowledge, essential for their future careers and lifelong learning (Levi, 2017; Head & Eisenberg, 2010).

In terms of community impact, the research has encouraged active participation from students, creating a dynamic, collaborative learning environment. The implications of these findings underline the importance of these pedagogical strategies in the development

of effective bilingual learning environments. Further research and depth into the components of MABA is recommended to continuously adapt and improve the effectiveness of these strategies in this evolving educational landscape.



Limitations

This study had certain limitations that need to be acknowledged. Primarily, the timeframe for implementing the project and conducting the classes was restricted due to multiple extracurricular activities that the students were engaged in. Research groups, spiritual retreats, and ASCUN qualifying games were among these activities, which on several occasions disrupted the established schedule for the project implementation.

These disruptions potentially affected the regularity and consistency of the instruction, thus might have influenced the results of the study. While every effort was made to ensure rigorous data collection and analysis, the findings should be interpreted with this limitation in mind. This limited timeframe also might have restricted the extent to which the project's impact could be fully assessed and observed. Longer implementation and observation periods could provide more comprehensive insights into the long-term effects of the transdisciplinary approach and PBL on students' learning and development.

In future research, it would be beneficial to coordinate more effectively with the extracurricular activity schedule, ensuring minimal disruption to the implementation of the pedagogical intervention.

Further research

For future research, it is proposed to disseminate the findings of this study at the Centro Internacional de Lenguas y Culturas Extranjeras (CILCE) in Bucaramanga. The goal of this dissemination would be to explore the feasibility of integrating the strategy of transdisciplinarity for the enhancement of 21st-century skills, faced with real-world challenges, through project-based learning in diverse groups of English as a Foreign Language (EFL) learners. This would not be limited to physical education students but would expand to Bachelor of Arts students from various academic programs. This proposed research would seek to ascertain the applicability and effectiveness of the transdisciplinary approach in these varied contexts, providing further empirical evidence to support the incorporation of such strategies in EFL teaching and learning across multiple disciplines. It is hoped that this future study would contribute to a growing body of knowledge on the intersection of transdisciplinarity, project-based learning, and the development of 21st-century skills, shedding more light on effective pedagogical practices in higher education.

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Appendixes

Appendix A: [Informed consent forms](#)

Appendix B: [Diagnostic test and observations](#)

Appendix C: [Lesson plans](#)

Appendix D: [Students' artifacts](#)

Appendix E: [Posttest](#)

Appendix F: [Interviews and online questionnaire](#)