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Ma-Fi-Son: Mathematics – Physical Education and Sonsureño. Transversalizing knowledge

Ma-Fi-Son: Matemáticas – Educación Física y Sonsureño. Transversalizando el saberé

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ABSTRACT

In response to the declaration of Sonsureño, as cultural and musical heritage of the city of Pasto, Colombia, dating from October 2016; at the San Pedro de Cartago institution, it was decided to start a project from the area of physical education in order to highlight the importance of dance and its practice; therefore, in conjunction with the mathematics and physics teacher, the project was promoted in which the movements made by certain people when practicing the rhythm of Sonsureño were evaluated.

For this purpose, the critical social paradigm with a qualitative approach was adopted methodologically with the support of participants: students and teachers of grades 10 and 11 of the educational institution. Seven (7) musical pieces of Sonsureño were selected, subsequently research and transversalization process was carried out in which the learning of different mathematical and physical concepts could be confirmed, from dance and play with the purpose of strengthening the knowledge of the students, especially, the understanding of basic operations.

RESUMEN

En respuesta a la declaración del Sonsureño , como patrimonio cultural y musical de la ciudad de Pasto, Colombia, que data de octubre del año 2016; en la institución San Pedro de Cartago, se decidió iniciar un proyecto desde el área de educación física con el fin de resaltar la importancia de la danza y su práctica; por ello, en unión con el docente de matemáticas y física, se impulsó el proyecto en el cual se evaluaron los movimientos realizados por determinadas personas cuando practican el ritmo del Sonsureño.

Para ello se adoptó, metodológicamente, el paradigma crítico social con enfoque cualitativo con el apoyo de participantes: estudiantes y docentes de los grados 10 y 11 de la institución educativa. Se seleccionaron siete (7) piezas musicales del

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Sonsureño, posteriormente se realizó un proceso de investigación y transversalización en el cual se pudo confirmar el aprendizaje de diferentes conceptos matemáticos y físicos, desde la danza y la lúdica con el propósito de fortalecer los saberes de los estudiantes, en especial, la comprensión de las operaciones básicas.

1. Introduction

Dance has been manifested since the origins of man, as an element to express oneself, socialize, make known customs and traditions, or perhaps to have fun at a celebration or social gathering; Therefore, its representations have gone beyond the scope of the scene, to an implication in historical development, demonstrating that dance acquires integral dimensions that are addressed by different researchers, of which it is pertinent to appropriate the definition of one of them (1997). in the following terms [1]:

> Dance is a universal human activity, since it has been performed in all times, geographical spaces, and is practiced by people of all ages; motor, because it uses the body as a means of expressing ideas, emotions and feelings; versatile, because it has artistic, educational, therapeutic and leisure dimensions; and complex, because it allows the interaction of biological, psychological, sociological, historical and aesthetic factors (p. 15).

In that sense, Nariño, and in particular Pasto, could not be the exception, since, since ancient times, mothers and grandmothers have enjoyed the "Quisindi-Quindi" with their babies, either to silence or shake (dance) the children. the little ones [2]. Therefore, from childhood, a love for dance, music and art is encouraged, something that can be clearly seen in the Carnival of Blacks and Whites, considered Intangible Heritage of Humanity, where there is a display of art, color and of course, music and dance. It is necessary to recognize the social, cultural and historical role of dance, when resorting to the following argument [3]:

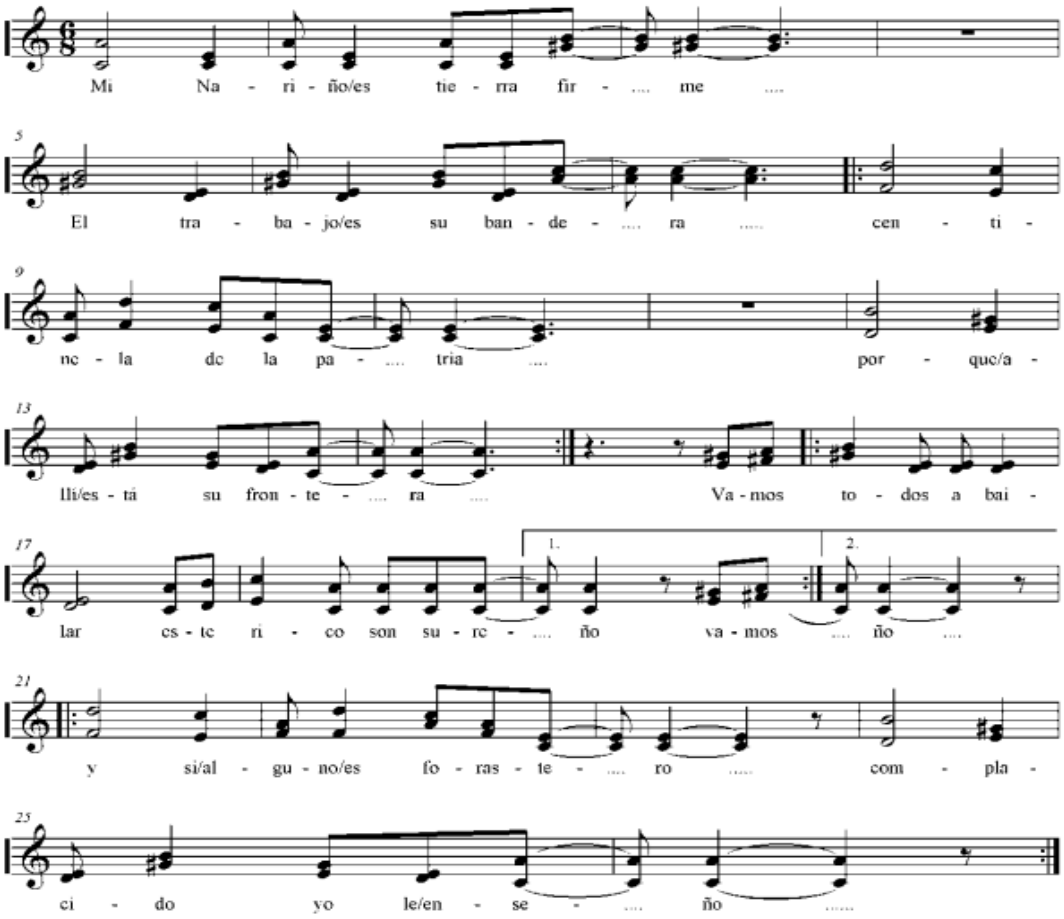
> The language of dance is part of the materialization of the activities of the human being, of what surrounds him and that depends on his intellectual development in society, which confirms that it also had different stages in which changes in values can be observed, ways of life, customs that have an important significance, according to the similar or different references of the community; then, dance would be a vehicle of communication and choreography would be the engine to transmit that way of life (p. 39).

For their part [4] some experts recognize the social component of dance by stating that "it is one of the few activities in which direct contact and spontaneous search for oneself are accepted" (p. 64). Likewise, dance favors the simultaneity of gestures and tonic agreement, considering rhythm as an element that generates deeper communication, strengthening non-verbal communication as an essential part of social processes in which various elements, behavior and manners to communicate interact in a given context [5].

This is how the communicative importance and influence on the transformation of societies that dance constitutes is identified and that, especially, in the Nariño region, it is developed under a systematic discussion of the Nariño region about the word "Sonsureño", which alludes to two arguments: firstly, the composition from the 60s created by Tomás Burbano Ordóñez, a production made by Ronda Lírica, as seen in figure 1.

In that decade and named that way; from another position, the increasingly widespread designation of a "typically Nariñense" rhythm that had its origin, according to some critics of the time, in the work of Burbano, although for some, it dates back a long time; But specifically, going back to history, the

Figure 1. Version by Javier Fajardo Ch. [6].



origin of the word "Sonsureño" does not exceed the decade of the sixties [6].

Hence, around the Sonsureño, that tune of the ancestors, and representative and popular rhythm of the Andean zone, which in the words of a writer on the subject, expresses: it circumscribes an intimate plane of the Andes of southern Colombia, determining, semantically, a unique and particular force of music born in the heart of the people: mestizo, black and indigenous [6] (p.25).

Although the importance of dance in different cultural and social spheres is evident, it is a notable fact that, historically, its scope and impact on education has not been widespread, and it was not until the 20th century that the first theoretical attempts began to be generated. and practical, which sought the inclusion of dance as an indispensable element in comprehensive training [7], cited by [8].

From that moment to the present, considerable progress has been made, but there is still a long way to go in the integration of dance at an educational level, therefore [9] the role of dance in education is based on one's own experience through of the body and its movements, explaining that "one of the objectives of dance in education is to allow, through dance, the identification of the bodily relationship with the totality of existence" (p. 111). From this perspective, it is argued that:

> Dance in educational contexts allows the exploration of the possibilities of movement that favor bodily mastery and expression through the body, it also allows the experience of different elements such as the body, space, energy and time, for the understanding and use of movement as a means of representing and expressing perceptions, images, ideas and feelings [10].

In this context, it is important to turn to other experts in this discipline for whom "dance has important pedagogical validity because it acts as a factor of cultural knowledge, in addition to allowing an intercultural approach that favors knowledge, acceptance and tolerance" [11] (p. 34). From this premise, a personal rooting towards cultural identity arises, which allowed the development of this research, beginning with a significant experience, called MA-FI-SON, through which a transversal project was developed that involved the steps of this rhythm in learning mathematics.

Based on the above, the objective of this reflection article is to demonstrate the application of mathematics in the practice of the rhythm and dance of Sonsureño in students of grades 10 and 11 of the San Pedro de Cartago educational institution in the department of Nariño who, like the teachers, were committed to the development of the proposal, in a comprehensive manner, both in the practice of the activities and in their analysis.

Structurally, the social critical paradigm with a qualitative approach was adopted, methodologically, which [12] "is an investigative paradigm focused especially on the social sciences that is neither purely empirical nor only interpretive, and whose contributions are based on community studies and participant research" (p. 98). In this paradigm, the researcher is a guide, facilitator, and an agent involved in the study group, allowing effective linkage in the development of a project.

Complementary to the referenced paradigm, the study was framed in the Participatory-Action-Research (PAR) method, which "implies the complete and open inclusion of the participants in the study, as collaborators in decision-making, committing as peers to ensure their well-being" [13] (p. 583). That is, in the analyzed context, the participation of students and teachers is required to achieve improvements in the teaching and learning processes through dance, which is why said IAP methodology is fundamental in generating changes in the way of teaching mathematics.

As materials, seven (7) musical pieces by Sonsureño were selected, recognized as Cachiri (Ronda Lírica), Miranchurito (Ronda Lírica), Soy Nariñense (El combo de las estrellas), No me dices (Los Ajices) and Vengase a Nariño (Amadeus). For this, it was important to apply mathematics in an experiential and playful way, to subsequently disseminate dance as a learning method in the analyzed context, and finally, to relate the movements of the Sonsureño with numerical, geometric and random thoughts.

2. Development of the theme

2.1. Development of experience

The development of the significant experience MA-FI-SON (mathematics, physical education and Sonsureño), arises from a conversation between two teachers and at the same time husbands, who decided to unite their lives and their knowledge in search of improving educational practices in mathematics and physical education. The physical education teacher, for her part, recognizes dance as an element that contributes to overcoming the traditional and monotonous way of teaching mathematics and other exact sciences, in which the teacher focuses on his master classes, old school classics, limiting itself to the use of the board and not looking for playful strategies

that favor meaningful learning (knowledge from the past fused with current knowledge), which allows students to generate and manage new knowledge.

During the implementation of the experience, the mathematics teacher began the process with resistance, however, the interest in finding strategies that would benefit the teaching and learning process is notable, allowing, in January 2017, to begin the proposal through of a dialogue between the authors, with the intention of participating in a call for significant experiences in the department of Nariño; For this purpose, the invitation was chosen and the first investigative investigations (explorations) began, beginning to construct a document in the company of a group of seven (7) students from the San Pedro de Cartago educational institution.

This is how the study group was consolidated week by week in order to carry out constant and participant observation, with a field diary, defined as a didactic tool that allows the teacher/researcher to know, through of writings, descriptive, analytical and critical records, behaviors, events, visual records of educational practices and other characteristics that are presented around the observation technique [14].

With the described method, it was possible to compile the progress of the project and, subsequently, it allowed this work to be examined and evaluated, for which, and in order to facilitate the interaction between the participants and teachers, an informative WhatsApp group was created, which allowed carrying out a joint and participatory research. Likewise, a prior consultation was carried out on the concept, origin, basic steps and typical figures of the Sonsureño, all of which was considered important for the appropriation of the subject willing to work on.

In the field or action intervention, billboards were created, drawing Cartesian plans that were used to make graphic representations and practical demonstrations of the movements and their relationship with geometric and trigonometric figures. With the help of a videobeam, the Chakana or indigenous cross was located, which also represents a Cartesian plane and allows these figures to be contemplated from the anatomical position, starting the mobile projection of arms, legs, feet, or specific clothing.

During the development of the project, interviews were conducted with teachers in charge of musical and dance processes in the municipalities of San Pedro de Cartago and San Juan de Pasto, evidencing the incidences of Sonsureño presented in the proposals, as well as the difficulties raised along the way; In addition, the meetings consolidated bonds of friendship, constant discussions and a lot of movement, since, to the rhythm of music and dance, mathematical knowledge was found that was not made known to the naked eye.

To give visibility to the project, it was important to intervene in events that would allow us to glimpse its power, for which it was important to participate in a science fair in the municipality of Arboleda-Berruecos, giving a theoretical-practical presentation of what has been investigated up to this point. moment that allowed the proposal to be placed within the 10 best significant experiences in the use of free time, occupying first place in said event; This was an inspiring path for many students, who were part of the seedbed and who today continue their professional training, to investigate and look for useful and innovative alternatives to achieve knowledge.

2.2. Findings

Before addressing the analysis from physical education and mathematics, it is important to recognize that Sonsureño represents the cornerstone of the musical identity of the Andean Zone of the department of Nariño [15]. From a social perspective, this rhythm is the manifestation of the idiosyncrasy of the rural and urban communities of this region and

constitutes a fundamental element for the determination of the traditional dance that presents ambiguity, due to the accompaniment rhythm influenced by the Albaso of the border area with Ecuador, the currulao of the Pacific Coast and the bambuco derived from the Andean zone of Colombia [16], but the latter, the bambuco, with one of its most representative exponents, such as Luis E. Nieto, (figure 2 and 3) corroborates the Caucasian origin as the most widespread among different researchers, when compared in its classical and contemporary writing.

This confluence of rhythms allows the Sonsureño to be structured, an object of strengthening the identity of regional music and the strengthening of intercultural educational practices as was done through the teaching and learning of mathematics.

2.2.1. Analysis from physical education

The culture of the department of Nariño has been recognized by the continuous practice of Sonsureño, since childhood, proposals for cultural presentations are made that promote said rhythm. In this sense, the experience transmits cultural roots to the young generations [18]. Likewise, a contribution was found to the physical state of the students and teachers who participated in the research, since when movements are executed based on this tune, the agility, strength and flexibility of the muscle groups found in the head are developed, the trunk, arms and lower body.

Figure 2. Classical writing [17].

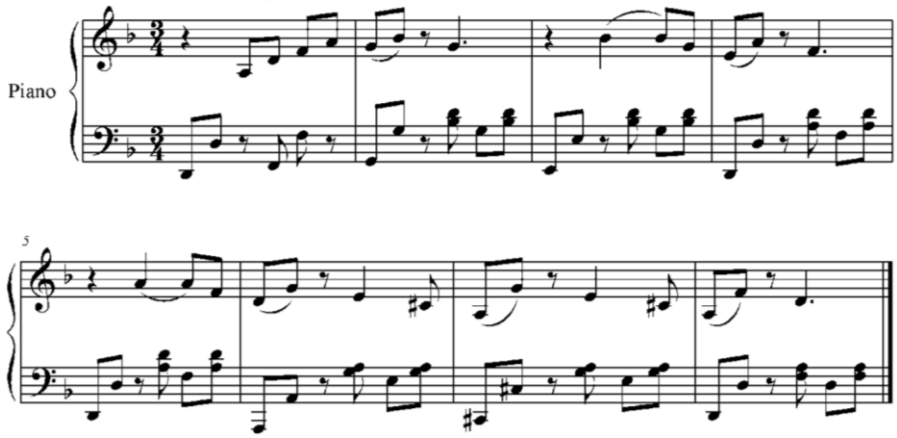
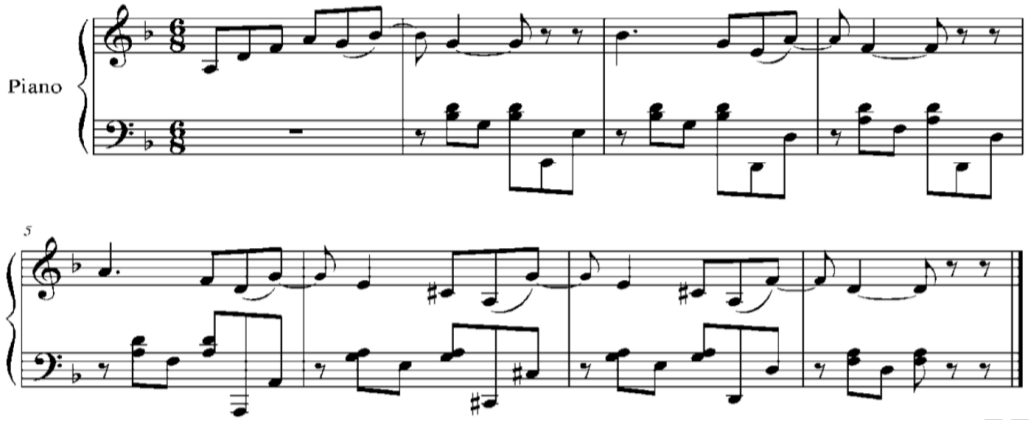


Figure 3. Contemporary writing [17].



Now, in coherence with the studies resumed, one of its main exponents of dance, stated that this discipline provides benefits to the mental and emotional aspect of the human being, helping with the strengthening of self-esteem, as well as with interpersonal relationships [18].

For this reason, when a didactic proposal is developed, which finds in dance a strategy to make knowledge more attractive, the emotional benefits that dance brings are also obtained, a pleasant atmosphere is recognized around the participation of students, a receptive and purposeful attitude is identified in them that, in addition to facilitating their understanding of mathematics, allows them to get closer to teachers and classmates, generating better conditions of sociability and a pleasant atmosphere in their educational and family environment. and social [19].

2.2.2. Analysis from mathematics and physics

According to what was previously stated, in Sonsureño and, in general, in dance, a strong application of physics and mathematics has been identified; Therefore, it begins by analyzing the dancer's position from a Cartesian plane, and with the help of this, some of the dancer's postures can be identified and parameterized through shapes, figures and angles.

On the other hand, the application of rectilinear, accelerated, harmonic, circular and semicircular movement is evident, taking into account the center of the body as the central axis (Y axis), and with all this information an identification and classification of the different movements applied; the rectilinear is performed since the steps, from the basic one, are done with constant speed by the dancer and, in general, by the group, due to the joint coordination of the entire cast evident in the entire choreography.

When the step called "brushing" is examined, the semicircular movement is observed, taking the hip as the vertex and with the legs forming a triangle and with the help of this and using semicircular movements with each of the legs this step is formed, in which speed, frequency and height are present to achieve perfection in the movement. When the step called the drag is analyzed, lateral displacements are applied, influencing these by the angle formed between the legs, the frequency with which the movement is made from side to side, as can be seen in the following figures numbers 4, 5 and 6.

Figure 4. Movement 1 [20].

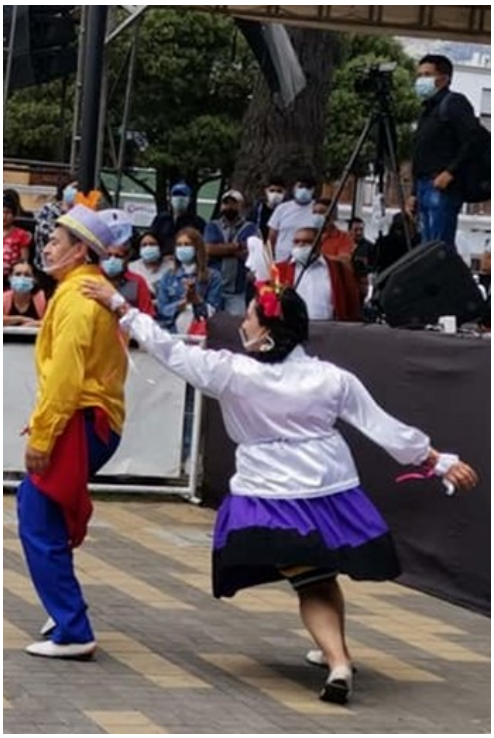


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Figure 5. Movement 2 [20].

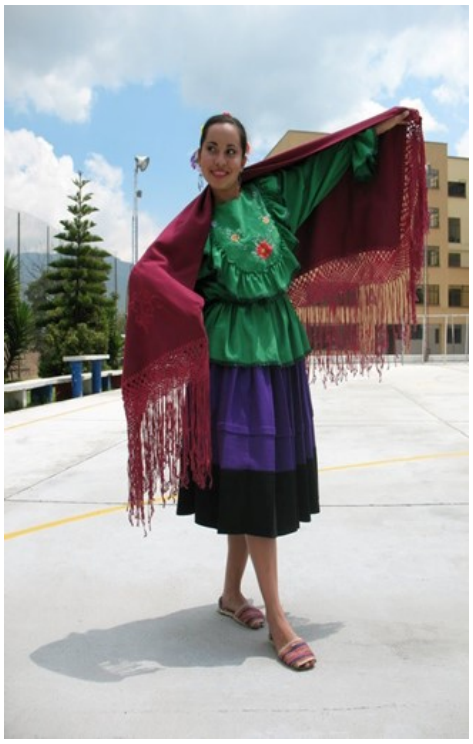

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Figure 6. Movement 3 [20].

From this perspective, in the Sonsureño dance it is also identified in the position of the hands and the objects used to perform a dance of this nature, which are also represented and governed by mathematical and physical laws, with which curves can be identified in movements. sinusoidal and cosineoidal, and circular movements when the "unwrapping of the drapery" is performed, taking the dancer's head as the central axis.

But current research not only generates alternatives to adopt technological strategies to implement in the discipline of Sonsureño dance, but the interest of researchers transcends recreational scenarios from the discipline of exact sciences, such as mathematics and physics, but has also appropriated of massive spaces to instill in the Nariño population the passion and love for native folklore, as seen in the following figures 7, 8 and 9.

Figure 7. Entry position [20].

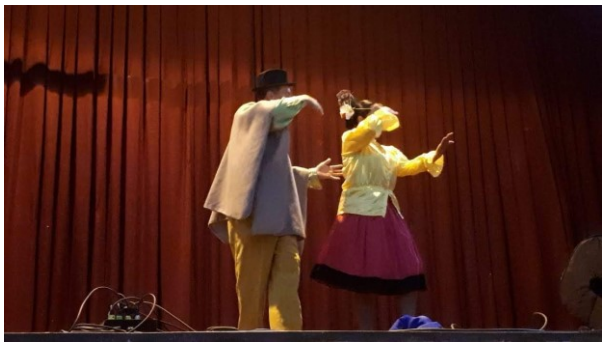

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Figure 8. Unwrapping the scarf [20].

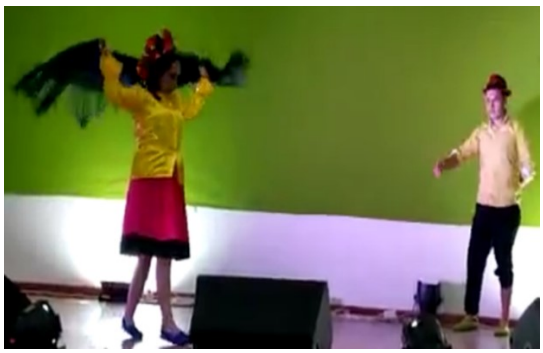

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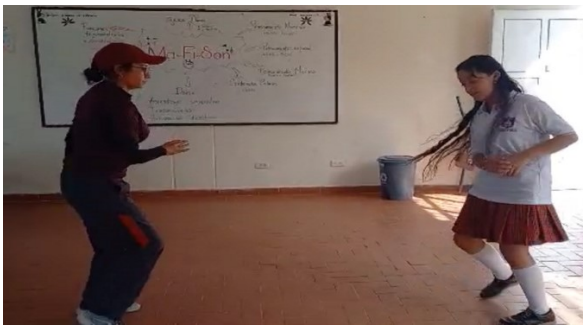
Figure 9. Three-quarter 3/4 brushed pitch.



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2.2.3. Development of a virtual learning object (OVA)

Currently, digital tools have been favorably accentuated in education. During the Covid-19 pandemic, they were an alternative that facilitated the teaching process and were widely accepted by students. Thanks to this experience, they have remained within the classroom favoring processes, facilitating them and providing motivation and a different and fun way of presenting content.

Play, art, entertainment, literature and the exploration of the environment come to life in the work strategies used to enhance the development of children, adolescents and young people (NNAJ). Without a doubt, these types of activities allow them to develop skills and abilities specific to their age; through technology, activities that are related to these topics can be generated [21].

OVAs are mediating tools due to their high influence of Information and Communications Technologies (ICT) on student motivation, so immersing the teacher in the world of ICT can help them achieve their objectives. that is proposed for any subject, due to the transversal curricular role that they have achieved, since it has free virtual courses or software, listening to texts, pronunciation of phrases and/or words, reconstruction of words, selection of words among several and above all virtual games.

The above can be designed on free sites such as Hot Potatoes, Educaplay, Glo maker, Hopscotch, Squeak, Quiz Faber, Join quiz, among others, applications for creating fun activities such as dancing, diagrams, riddles, crossword puzzles, soups. letters, matching, puzzles and many more things that will be reflected in the design of the technological tool proposed with this research [21].

"It is proven that the appropriate use of technological tools, including OVA, enrich teaching work and learning" [22], so there should be no reason to refuse the use of ICT in the classroom. However, it must be considered that, despite the significant contribution that these tools provide when used within educational practice, they should not be applied as the solution to the educational problems that arise in classrooms, since they do not guarantee one hundred percent. percent of student motivation and interest.

Given the previous context, and giving continuity to the significant experience, the authors decide to participate in the course: My_red - your_red: digital educational resources, case of the OVA, from teachers to teachers - physical education, recreation and sport, where you can observe the didactic transposition between the aforementioned disciplines and, in turn, different processes are carried out that aim to promote the acquisition of knowledge from a playful perspective, through the use of technology.

In this sense, an interactive infographic is built that has videos of the steps and figures of the Sonsureño, as well as the concepts that one wishes to appropriate from mathematics, as well as guides that facilitate knowledge. Finally, this resource is found on the "Colombia learns" portal and symbolizes the achievement of a project that has resumed the meeting of several disciplines in the classroom.

The creation of an OVA led to the dissemination of the significant experience in one of the largest educational platforms in the country, called "Colombia

Learns", where different didactic strategies appropriate to teachers, parents and students are made available to the needs of interested people or the subjects offered in the majority of educational institutions in the country.

From this perspective, this project, in addition to promoting a transversalization of two areas of knowledge that, perhaps from everyday life, will not have greater relevance, aims to redefine the traditional knowledge of the communities, in this case the Sonsureño dance, and initiate the concatenation of links that facilitate teaching and learning processes inside and outside the classroom.

Below is the link to the page that contains the educational learning resource called: Ma-Fi-Son: mathematics, physical education and Sonsureño. A didactic transposition at the service of two areas through dance - Sonsureño musical rhythm and typical dance of the southern region of Colombia and its relationship with mathematical concepts.

http://www.colombiaaprende.edu.co/recurso-coleccion/catalogo-de-contenidos-4

3. Conclusions

In coherence with what has been mentioned by some writers and enthusiasts of entertainment, both in ballet and in mathematics, the beauty of structured forms underlies, which allows for a mathematical reading of dance, mathematically identifying the elements that appear in this artistic discipline [23].

Through significant experience, it was possible to contrast the multiple mathematical-dance relationships, especially in the field of graphic structures, which allow the relationship with geometry. However, it is possible to identify other meeting points, which can allow the development of new research, such as the linking of the structure of the steps with algebra; Relationships were also found that can be used in the initial teaching of mathematics, such as the application of dance to understand basic operations.

Likewise, in the steps of the Sonsureño, many physical laws are applied that are governed by mathematics, as has already been mentioned. In addition to all this, the applied forces must also be identified, the height, the weight, the frequency of the movements. , the angular velocity.

Finally, the research made it possible to show that, indeed, mathematical knowledge is strengthened when movement and body awareness are involved, and the possibility of incorporating dance into the school curriculum, in a transversal way, to increase the appreciation was also envisioned. of the corporal, as a learning engine and manage to replace the paradigm of the NNAJ about "mathematics is boring" and replace said paradigm with a renewing and passionate attitude towards this important area of knowledge.

Recognitions

The authors express their gratitude and recognition to the directors, teachers and students of the San Pedro de Cartago educational institution, Nariño, who year after year have participated in this project, and which today is materialized in an academic exercise that will serve as reference for other institutions, not only in the department of Nariño, but with the benefit of institutional inventory at the national level.

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