

Actividad física para la motivación y aprendizaje de matemática de los estudiantes de cuarto básico
Physical activity for the motivation and learning of mathematics in fourth grade students

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Resumen

El contexto pos pandemia evidencia falta de motivación y problemas de nivelación de aprendizajes a inicio del año académico. El propósito de la investigación es indagar los beneficios de la integración de la actividad física para la motivación y el aprendizaje de matemática de los estudiantes de cuarto básico, para ello, se implementa la estrategia de trabajo colaborativo denominada aprendizaje en movimiento. Los resultados se miden a través de una prueba y un cuestionario, lo cual evidenció un aumento favorable en la motivación y nivelación de los aprendizajes en matemática de los estudiantes cuarto básico por la integración a la actividad física.

Palabras clave: Actividad física; Motivación; Aprendizaje; Trabajo colaborativo.

Abstract

The post-pandemic context evidences lack of motivation and learning leveling problems at the beginning of the academic year. The purpose of the research is to investigate the benefits of the

integration of physical activity for the motivation and learning of mathematics of fourth grade students, for this purpose, the collaborative work strategy called learning in movement is implemented. The results are measured through a test and a questionnaire, which showed a favorable increase in the motivation and leveling of mathematics learning of fourth grade students through the integration of physical activity.

Keywords: Physical activity; Motivation; Learning; Collaborative work

Introduction

The current post-pandemic context that society is going through and the consequences of the change from face-to-face to remote education. This brought with it a series of difficulties in the pedagogical field, since with the return to face-to-face classes, the consequences of the social context due to the physical distance and confinement experienced during the pandemic can be appreciated. This undoubtedly generated an atmosphere of uncertainty, which especially affected the students, with curricular alternatives due to the lack of motivation and learning leveling problems that the students experienced at the beginning of the academic year, which questioned the forms of the teaching-learning process.

All this leads to a management analysis of the curricular implementation applied in the context of a school and the various pedagogical practices aimed at the integral development of students, so that they can develop competencies through performance and thus put into practice the 21st century skills related to the ways of working as collaborative learning to achieve deep and meaningful learning.

According to the above, it is of vital importance to motivate students to promote their own learning, through the use of various activities, dynamic and articulated; in a collaborative manner between the different subjects. They will be intellectually active and will learn during face-to-face classes to achieve their leveling.

It is essential to address the key elements mentioned above for an effective implementation of the curriculum, since the essential elements for curriculum implementation are interrelated, i.e., the importance of coherent planning with didactic strategies for teaching and learning and the evaluation of student learning: These elements are of vital importance for the development of knowledge, skills, attitudes and values expressed in the students' performance, thus cementing a quality education.

Within the current regulations in force, Law 20.903, they highlight the importance of collaborative work as one of the principles, with the aim of strengthening pedagogical practices and enhancing the continuous improvement of student learning (MINEDUC, 2019). Therefore, collaborative work

activities should be organized among the different subjects that allow creating activities that will help the use of time for the implementation of the prioritized curriculum and an effective motivation of the students. It is understood that it is difficult to achieve true learning if the students are not motivated.

The representative sample of the population corresponds to students in the fourth basic year; the results of the diagnosis show that 71.6% show insufficient performance in their concentration; the pre-questionnaire includes the students' perceptions regarding their interest and willingness to learn, their academic expectations and motivation to achieve, and their attitudes towards difficulties in study, and the results show an average concentration of 63.7% among negative or undecided answers about their level of motivation.

Accordingly, the general objective of the research is to investigate the benefits of the integration of physical activity for the motivation and learning of mathematics in fourth grade students. The specific objectives: to identify the benefits of the integration of physical activity for the mathematics motivation of fourth grade students; and the benefits of the integration of physical activity for the mathematics learning of fourth grade students.

Development

The key to educational transformation is focused on leading the pedagogical core, since the quality and effectiveness of learning in the classroom is mainly determined by what happens in the teacher's encounter; it is mainly considered, their skills and the active role of the student in front of the knowledge or educational content (Elmore, 2010). Therefore, the type of pedagogical interactions that occur in the classroom are of vital importance to promote improvements in the teaching-learning process.

In line with the above and in order to develop practices that involve the aforementioned, the decision is made to use the collaborative work strategy called: a learning in movement/ since motor activity is implicit in the acquisition of all learning. It is possible to work with students and activate the body with simple exercises between classes (Domínguez, 2019, p.74).

In this strategy, the principles of physical activity corresponding to the subject of physical education and health are integrated to develop activities. These promote learning and motivation of students; higher level skills are developed such as learning to learn, for reasoning and critical judgment in the face of the exposed problem; the learning that students develop based on this methodology will be built from experiences that are meaningful to them, considering that motivation goes hand in hand with positive emotions, and that this will produce an improvement in the acquisition of learning.

It is essential to understand what the learning process consists of, the different theories that support them and their relationship with didactics and evaluation, since all of this contributes to optimize the teaching task//, "learning is understood as a dynamic process in which students develop their knowledge, skills and attitudes in an integrated manner with the purpose of forming critical, creative, autonomous people, who build their identity and their life project" (MINEDUC, 2019, p.21),// since learning is a dynamic process guided by the teacher where learning to learn is a priority, it is directly related to the constructivist approach.

The aforementioned learning is based on the constructivist approach, which considers that the construction of learning is based on previous knowledge (actual development level), and that thanks to the mediation of the teacher and peers, i.e., scaffolding, the so-called ZDP (Zone of Proximal Development coined by Vygotsky, (2006) is produced; it favors students to achieve the acquisition of new knowledge and skills (Potential Development Level).

In correspondence with the above, it is essential to promote an environment conducive to learning where trust is generated among students, teachers and peer group; as well as to promote motivation, participation and collaboration based on the proposed objectives and facilitate the connection between what they know and what they will learn; the application of procedures that promote deep and meaningful learning: opinions and responses of students, highlighting the successes and mistakes to guide them in their learning and giving them a greater role for the development of necessary skills of the XXI century, such as collaboration among them.

In correspondence with the proposed objective, the implementation process of the didactic strategy takes into account the pedagogical principles of Mathematics: "it is a creative, multifaceted discipline that can provide moments of enthusiasm to the student when facing a challenge, of joy and surprise when discovering a solution at a glance, or of triumph when managing to solve a difficult situation" (MINEDUC, 2012, p.86). The aim is to develop mathematical thinking together with skills interrelated to: problem solving, representing, modeling, arguing and communicating (MINEDUC, 2012); essential when planning the curricular implementation process, since it transforms this scientific knowledge into an accessible and understandable one and agrees that: "mathematics is a privileged domain to improve and practice common sense, critical spirit, the ability to argue, perseverance and collaborative work" (MINEDUC, 2012, p.86).

Likewise, "the pedagogical principles of the subject of physical education and health are related to the development of motor skills. There is evidence documenting positive relationships between physical

activity and cognitive abilities" (MINEDUC, 2013, p. 162). The central axis corresponds to motor skills, "since the practice of physical activity and exercise represent fundamental variables for the optimal development of cognitive processes, such as perceptual mechanisms, problem solving and memory" (MINEDUC, 2013, p.164).

The process of implementation of the proposed strategy takes into account an order, structure and stages of travel; the procedure used to carry out the class is based on weekly meetings jointly between the teacher of the subject Mathematics and Physical Education and Health; it is planned according to the content to be fed back from the first one. Then, the teacher of the second subject chooses, creates the activity and the material to be used and takes into account the physical and ludic activity of the development of motor skills, according to the evaluation indicators, which allows the student to access the knowledge, the development of skills and attitudes necessary to achieve learning results at a higher level. This pedagogical strategy involves the interaction of these two disciplines where dialogue and collaboration among students prevails and strengthens their learning.

The structure of the class in which learning in movement is developed in the subject of mathematics considers the following premise "Physical education generates a series of acute and chronic responses that promote conditions that increase cognitive performance" (Riquelme et al.,2013, p. 69), therefore the strategy is based on circuits where basic motor skills and physical activities such as coordination (hand eye, pedal eye), balance (static-dynamic), displacement (walking, jumping, galloping, running), manipulation (throwing, catching); are integrated to the development of mathematical skills such as problem solving, representing, modeling, arguing and communicating in familiar situations. All this involves applying what is learned theoretically, in addition to promoting teamwork, tolerance, respect, perseverance, to achieve motivation and learning of students in the subject.

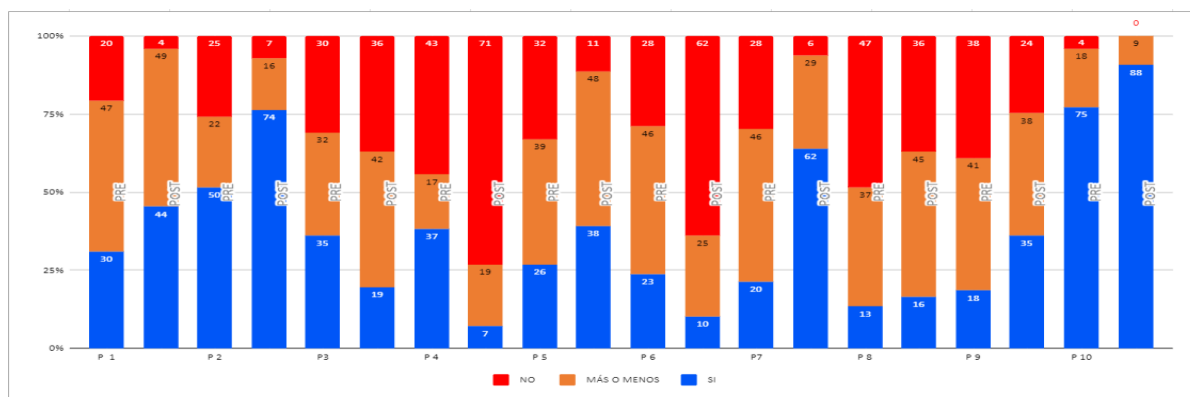
The learning in motion class is developed jointly by the teacher of the aforementioned subjects and outside the regular classroom, which allows generating an environment that motivates the student for the development and understanding of the content, since it is done in a collaborative manner, but also with individual participation. This allows monitoring and feedback of the learning process in a formative way to each of the students, as well as the skills in both subjects, to then make an effective feedback with the entire course and consider the evaluation indicators discussed in class.

Based on the research objectives, two corresponding survey instruments were applied to demonstrate the results:

Comparison of results pre and post motivation assessment questionnaire.

In order to know the results of the first specific objective proposed, a survey was applied to the students, to measure the students' motivation for Mathematics: their perceptions regarding their interest and willingness to learn, their academic expectations and achievement motivation, and their attitudes towards study difficulties. To evaluate this indicator, a 10-question questionnaire was used for 4th grade students. The questions applied were taken from the SIMCE 2010 student questionnaire, which measures the indicators of personal and social development.

Graph N°1 Comparison PRE and POST questionnaire Motivation for the subject of Mathematics



Source: Self- made

Graph N°1 presents the comparison of the results of the Pre and Post questionnaire that measures motivation for the subject of mathematics in the fourth grade.

Sample and methodology

The following theoretical and empirical methods were used in the work: analysis and processing of sources; hypothetical-deductive identified with the hypothesis proposed; as well as triangulation by means of a theoretical systematization based on an evaluative, critical and reflective analysis. Participant observation was used to obtain significant data for the diagnosis; as a methodological procedure, qualitative-quantitative contrast was used to determine the regularities of the historical study; analysis and synthesis for the foundation of the object, the field of action, to establish essential elements of the research, the relationship between them, the analysis of the data and empirical manifestations to determine the problem.

Discussion:

The following is a comparative analysis of the results obtained for each question:

Question N°1, in general I do well in mathematics: when observing the results and making the comparison between the pre and post questionnaire in relation to whether I do well in Mathematics,

30.9% obtained a considerable increase to 45.9% and the results obtained are decreased from 48.5% to 50.5% and "no" 20.6% to 4.1%. At the beginning of this school year 2022, after the world pandemic, where most of the schools in Chile lived realities such as the delivery and reception of learning, the use of ways to access it, the socioeconomic level of the school, it was found that not all students could access to education although the school facilitated the conditions. Hence the evidence of the difference in these results. At present, the student has the support of parents and teachers; and the face-to-face classes together with Mathematics and physical activity have provided feedback every week, learning until the achievement of the proposed objectives in most of the students of the course.

Question N°2, I would like to have more mathematics classes at school: it is verified in relation to "I would like to have more mathematics classes at school" from 50.5% of the Yes option in the pre-questionnaire increased to 76.3% and in the post-questionnaire it is evidenced that the implementation of the joint classes of the subjects results were obtained: the option more or less 22.7%, and the option no 25.8% went down, with 16.5% Y 7.2%l. When the time comes and the time to conduct the class together, we observe the excitement and motivation of each student to participate; a significant increase is evidenced in those who choose to have more Mathematics classes in motion; this is because the pre-questionnaire students were not familiar with the implementation of this strategy, but then knowing it, we observe their motivation, the desire to learn and participate.

Question N°3: Mathematics costs me more than the rest of my classmates: the answers of the pre-questionnaire when compared with the answers of the post-questionnaire, after the implementation of the project, it is observed that among the indicators that the answer Yes went from 36.1% to 19.6%, more or less 33% and increases to 43.3% and the option No 30.9% increases to 37.1%; this shows the students' acceptance of the strategy. Although a greater number of students who chose that it does cost them mathematics more than their classmates in the post-questionnaire were observed. There is a decrease in the number of students with this criterion, after implementing the strategy and it is observed that the personalized work, the constant feedback of the objectives taught show results.

Question N°4, when I do badly in Mathematics, I give up quickly: the considerable decrease of the answer yes from 38.1% to 7.2% demonstrating that the students face in a persevering way the subject of mathematics in the comparison between pre and post questionnaire, in the same way are evidenced in the following answer alternatives, more or less: 17.5% to 19.6% and from 44.3% in the option No, it increased 73.2%. Perseverance and constant effort is important to achieve the objectives of the subject through physical activity, which has given good results, also the error has been used as a way of

teaching and directed to each student to consider the error as a learning opportunity, therefore, they can try as many times as necessary and rely on the guidance of teachers and/or classmates.

Question N°5, I learn mathematics easily and quickly: in the pre-questionnaire 26.8% of the students answered that they learn mathematics easily and in the post-questionnaire there was an increase to 39.1%, and when comparing those who learn more or less increased from 40.2% to 49.5% and those who do not learn easily decreased from 33% to 11.3%. In the first classes, the students were not concentrated or persevering; they were not able to continue with the activity, they gave up instantly; after the implementation of the learning strategies in movement, the students were motivated and willing to learn; they were able to acquire the key knowledge to put it into practice in the mathematics classes together with the physical activity; the process was not easy or fast, each student has his learning time, but their perseverance and perseverance to learn are observed.

Question N°6, I find it difficult to learn Mathematics, and I think it will always be difficult for me: changing the perspective of a subject with a future vision is what can be observed in the results of this question, the indicator Yes from 23.7% decreases to 10.3%, the indicator more or less from 47.4% to 25.8%, also has a considerable decrease therefore an increase in the indicator No is appreciated which went from 28.9% to 63.9%. The results show that the strategies implemented for learning in motion, and the pedagogical interactions carried out during the process, such as constant feedback, work through error, scaffolding and modeling, have helped to consolidate learning and put into practice what has been learned in the subject of Mathematics, which leads to a change in the student-centered paradigm.

Question N°7, I enjoy studying Mathematics: We understand the results as an improvement after the implementation of the project, that is why the learning in motion motivated the students and we see it reflected in the option yes, I enjoy studying Mathematics obtains a significant increase from 21.3% to 63.9%, more or less 48.9% to 29.9% and the option no from 29.8% decreased to 6.2%. Nowadays, after a world pandemic, moving around, leaving the common classroom and sharing, seems interesting and fun to everyone, always taking mathematics to everyday life and accompanied in this case by physical activity, which has motivated students to learn both the subject and the values that are put into play within the class indicated.

Question N°8, I get good grades in mathematics without needing to study: after the pre and post questionnaire and a comparison, 13.4% in the Yes option is obtained at the beginning and increases to 16.5%, with the highest increase from 38.1% to 46.4%, and 48.5% in the No option decreases to

37.1%. The constant practice and feedback in the mathematics and physical activity class has decreased the gap between the different options, but when applying a specific evaluation that measures the evaluation indicators, a little more preparation is required, since some external factors play against them, such as noise, lighting, ventilation and chromaticism.

Question N°9, mathematics classes are easy and with little effort I do well: constancy and motivation to obtain good results is what the students internalize at the moment of implementing learning on the move, for which we observe the following results of the pre and post questionnaire, the option Yes from 18.6% increases to 36.1%, the more or less 42.3% decreases to 39.2%, and the no from 39.2% decreases to 24.7%. Success is the sum of small efforts that we work day by day with our students, within the objectives taught we know that there are some more difficult than others, therefore, the growth mindset of the students to achieve good results is important, and thanks to the math classes in conjunction with physical activity we have achieved motivation for learning the subject of mathematics, reflected in the results of the various evaluations conducted.

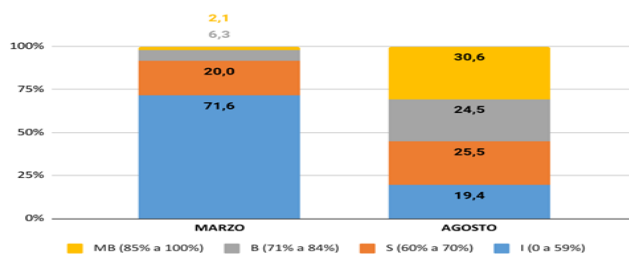
Question N°10, if I study, I do well in mathematics: Personal preparation is important, and together with the strategy implemented, the students feel prepared to face the evaluations, that is why the results obtained in comparison to the pre and post questionnaire, in the option yes they feel prepared 77.3% increases to 90.7%, more or less 18.6% decreased to 9.3% and the option no from 4.1% decreased to 0%. The question is related to question number 8, since students feeling prepared will be able to face an evaluative instrument in a safe way, besides the constant feedback and the motivation that physical activity contributes to the improvement of the expected results, which in this case are positive as shown in the results represented in graph N°1.

In order to know the results of the second specific objective, a diagnostic instrument was applied on two occasions: the first at the beginning of the academic year, and the second, during the month of August, the beginning of the second academic semester, in order to collect objective evidence of the implementation of the practice of learning in motion; the learning of fourth grade students was measured; The instrument is called integral diagnosis of learning and corresponds to an initiative of the Chilean Ministry of Education, since it constitutes a direct support to teachers and directors in the current context and evaluates the learning of the prioritized curriculum, with the objective of diagnosing and orienting the establishments concretely to recover the learning lost during the pandemic and to know the socioemotional state of the students.

The MD Mathematics Diagnostic assessment, applied in March 2022, considered the measurement of the academic area for the present research, since it evaluates the prioritized learning objectives of the thematic axes that students should have acquired in the previous level, in an articulated manner with the curricular skills. These learning objectives are organized into the following five thematic axes: numbers and operations, patterns and algebra, geometry, measurement and data, and probabilities.

The test applied to the three basic fourth grades of the school in March 2022, consists of 25 questions to collect evidence of mathematical learning in the previously defined thematic axes; students are required to show their knowledge of the concepts and procedures together with the different curricular skills, to account for the achievement of the learning objectives and the corresponding evaluation indicators of the Curricular Prioritization of the previous level. It was applied in August 2022; it corresponds to a sample of the evaluation applied in March, to the questions of the numbers and operations axis, that is, with a total of 15 questions. This March diagnostic is based on the fact that during the teaching-learning process corresponding to the first semester, only the numbers and operations axis was worked with the students.

Graph N°2 Percentage distribution of students by level of performance: DIA Diagnostic Evaluation Mathematics 4th grade, numbers and operations axis.



Source: Self- made

Graph No. 2 presents the comparison of the results of the diagnostic evaluation of the numbers and operations axis applied in March and August 2022,

As can be seen in Graph 2, the percentage distribution of students varied from the first to the second application of the instrument, since in March there was a clear concentration of students in the insufficient performance level, which ostensibly dropped from 71.6% to 19.4% of students, while the sufficient performance level increased slightly from 20% to 25.5% of students from the first to the second measurement; In the good level, there was a significant increase in the percentage of students included in this range, from 6.3% to 24.5%; finally, in the very good performance level, there was a

significant increase in the percentage of students included in this range, from 2.1% in the first evaluation to 30.6% in the second evaluation.

Conclusions

Considering the current post-pandemic context, the vertiginous changes, all of this demands to investigate and apply new pedagogical practices aimed at the integral development of students. Therefore, as teachers it is necessary to use a student-centered learning model, which facilitates learning, that is, the teacher becomes a guide, while students play a leading role and establish collaborative relationships, sense of responsibility and control over the learning process: they can learn with and from others, to perform activities and / or solve problems with much more active participation of students and greater involvement of these in the proposed activities, away from individualism, learning and motivation is favored.

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