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Impacts of the mathematical clinic in the academic performance of the students

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Abstract. The article present the scopes of the pedagogic model called “mathematical clinic” evaluated in students of fourth and fifth grade of the “Escuela Sagrado Corazón de Jesús, San José de Cúcuta, Colombia”, which has as principal aim analyse the impacts that the initiative had in the rate of academic mortality, those who on not having graduated of primary with an appropriation consolidated of the mathematics have difficulties in their performance during the following years. The methodology of the study is quantitative, correlational, since from the assistance, approval and disapproval his incident is calculated in the performance of the pupils. The results reflect high correlation, where the clinic has turned into a space effective learning in the institution into that students strengthened their interest for the different areas of knowledge.

1. Introduction

The mathematical clinic is a pedagogical model that seeks to identify, first, the critical subject matters relating to fractional numbers, in students of 4th and 5th grade and immediately afterwards to generate effective alternatives to mitigate the negative impacts of these in the students, stimulating the learning by means of an advising adjusted to the needs of each one. For this, there was created a system of academic alerts in order to treat the deficiencies presented by certain students in specific topics. Two types of alerts can be generated depending on the case. The service of "urgencies" is thought and suggests for those students to present difficulties in fractional numbers. Each of them will go of voluntary and autonomous form in search of advising. The "urgencies" will be available in all the school day, (mornings in the 8 to 12 hour, and afternoons in 14 to 18 hours). On the other hand, the service of unit of immediate services (USI), was assigned for those students by low academic performance, either for having reproved the subject in someone of the academic terms, or because the respective teacher considers it to be necessary.

The general aim of the project consists of offering a punctual, advice diligent and exact to the needs of the students with difficulties or deficiencies with regard to operations and applications fractional numbers. The specific aims refer to establishing a condition of the art on the learning process of fractional number in students of 4th and 5th grade in Colombia, designing the structure of the mathematical clinic based on the studies of precedents and condition of the state of art, establishing the learning strategies in the casualty department as in the USI and implementing in phase of test the mathematical clinic. It is important to highlight that both dependences have been attended by students of practice and magister in formation in education mathematical from “Universidad Francisco de Paula



Santander, San José de Cúcuta, Colombia”, with the support of the students of social service of the institution, selected and qualified by mathematics teacher's, who lead the project. Their work has been orientated by the leadership, social responsibility, proactivity, tolerance, honesty and vocation of service. The goals established for this initiative go from diminishing significantly the percentage of academic mortality, caused from the structure cognitive required in the solution problems with fractional number, increasing the capacity of knowledge and appropriation of the mathematics for 4th and 5th students to managing to develop a culture of learning based on numerical practice supported on the clinic. In general terms the mathematical clinic is a strategy that takes charge accompanying the students in condition of academic urgency, showing how across the actions and the will it is possible to raise the interest, the motivation and the performance of the students, in math.

2. Methodology

The investigation was realized by a quantitative approach, a perspective that in the vision of Hernández [1], uses the compilation of information to prove hypothesis, with base in the numerical measurement and the statistical analysis, to establish standards of behaviour and to prove theories. In this order of ideas, the investigation was first exploratory, later descriptive [2] and correlational. In addition, it was realized in four phases: valuation and diagnosis of the current situation, review of the literature to construct the condition of the art, design and development of the activities, to come finally to the evaluation of the impacts reached with the 4th and 5th grade students from the “Escuela Sagrado Corazón de Jesús, San José de Cúcuta, Colombia” in this four phases.

2.1. Phase 1

This phase develops the process of precedents, search of the condition of the art and description of the current condition of the problematics [3], in this stage there will be established a characterization of the population who was benefited by the process of the mathematical clinic.

2.2. Phase 2

Phase of design of strategies that compose the area of urgencies (USI), as well as the design of the mission and vision, values, beginning and policies and planning strategic for the functionality of the clinic. Likewise, in this phase the process maps are designed according to the clinical pathology of the student in all that the mathematical development.

2.3. Phase 3

Phase of implementation and functioning, in this phase the mathematical clinic is implemented in the totality, by means of the strategies and taking the students' characterization as a database in mathematical risk. The attention to the users begins in urgencies and in USI, clinical histories are opened and the treatment is begun to improve the learning process.

2.4. Phase 4

Phase of evaluation, in this phase there develops an analysis of the students' current situation in USI and in urgencies, there evaluates the functioning of the mathematical clinic and the impact later its implementation, there take corrective actions that improve the productivity of the clinic

3. Development

Across the years have been demonstrated by the academic performance in the area of mathematics. The subject is one of more mortality presents. The situation becomes critical in the “Escuela Sagrado Corazón de Jesús” from San José de Cúcuta, Colombia, specially, in the secondary 7th, 8th and 9th grades, where, in the year 2014 for example, less than 70% of the students approved the subject during every academic term. In ninth grade, furthermore critical, more than the half of the students they reproved the first three academic terms. In addition to, according to indicators and references on the part of the educational personnel of the institution, there is demonstrated that the majority of generated

difficulties appear for insufficiency in basic mathematical knowledge. One of them, more critics, are the fractions. Considering the previous thing, it was necessary to face and to manage the academic critical mortality arisen in secondary making emphasis in basic fundamental subject matters consolidate this way solid bases of knowledge and to facilitate the learning process in top degrees. During the last years in the academic area major development has been given it to the topic of the education and the learning of the fraction numbers, since the teachers have begun to design alternative strategies to favour his comprehension and assimilation in the time: researches established that an important result of his study was the recognition of which the children constructed a bridge between his knowledge of natural number and the initial conceptualization of the fraction, especially, in all the discreet ones [4]. For other part, observed in the pupils the use of graphs with explanations to expose his ideas [5], and indicates that the representations created by the children to express their ideas and to argue their answers them helped to solve the activities [6]. Nabors implemented an experiment of education constructivist with four students who interacted in a computational micro world used to solve tasks of fractional reasoning [7], they raise the interaction as important activity for the comprehension of this content.

In this line the pedagogical efforts are orientated to the students could solve problems with different situations and information resorting to the skill of being able to use well the fractions. In this measure, the efforts realized in the “Escuela Sagrado Corazón de Jesús”. They do not move away from the educational panorama in Colombia, where increasingly, one seeks to generate better conditions of learning for all the involved ones, the majority is based on the studies that across his theory of the intuitive constructs has penetrated into a topic that before was not possessing the necessary attention [8]. His contributions were included in the experience of investigation of the mathematical clinic and drove to link the most intuitive part of the mind of the students to approach that way the phenomenon of the numerical partition and to relate these ideas to some aspects of his reality [9]. In this form, there were established relations that were allowing them to conquer the resistance to the learning. In this direction invites to create relevant situations in the classroom or out of it, in order that the pupils meet moved to use their reasoning and mathematical knowledge. For this side, Solé and Coll emphasize the kindness of the constructivist paradigm to stimulate in the students a mental and personal representation of the taught topic [10]. The pedagogic orientation reflects that the project of the mathematical clinic done to strengthen and to consolidate the knowledge brings over of the subject matter of fractional in 4th and 5th graders [11], and hereby to anticipate and to mitigate the academic mortality demonstrated in secondary for deficiencies in basic, but fundamental topics for the academic development of the student

4. Results

The project started being evaluated from the phase of implementation to see reflected the results of the application of the strategies that improve the learning of the fractional ones in 4th and 5th primary student's. The instruments used were statistical analyses, bar charts and the integral behaviour of the student checking his academic performance in the periodic tests. In this measure is presented the results from 2016 until 2018 in what concerns the assistances and the impacts reached by student. The grades with major participation in the strategy of urgencies were 4th 02, 03 and 04, (Table 1).

The months with major intensity in the attention offered to the students were on April and August, both reflect the beaks of time in which major worry is generated in the pupils, with regard to their possibilities of recovering the achievements lost to approve the academic periods and to have major possibilities of advancing in the school year. In the strategy USI the grades with major participation were students from 5th grade, though in its development there received students of 3rd, 7th and 9th grade that they were incorporating due to the interest provoked by the project, (Table 2).

Meanwhile the months with major movement were in October and November, that is to say finishing the school year, which has logic because it is the approach of the strategy, to assist to those who have major difficulties and to reach reinforcements in the short term. The impacts of the clinic are demonstrated in since the same student can represent all the times need it and to approach different

topics: reinforcement of basic operations, division and solution of problems, geometry and operations with decimals, preparation for recoveries, between others (Figure 1).

Table 1. Groups with major participation strategy of urgencies.

Grade	% Urgencies	Grade	% in USI
401	15%	3	33%
402	21%	4	31%
403	21%	5	33%
404	21%	7	1%
405	13%	9	1%
501	9%		
701	1%		
TOTAL	100%		100%

Table 2. Months with major participation strategy of urgencies.

Month	F	F.a	F.r	Percentage
February-March	0	0	0	0%
April	90	90	0.44117647	44%
May	33	123	0.16176471	16%
June	10	133	0.04901961	5%
July	23	156	0.11274510	11%
August	48	204	0.23529412	24%
September-December	0	0	0	0%
Total	204	204	1	100%

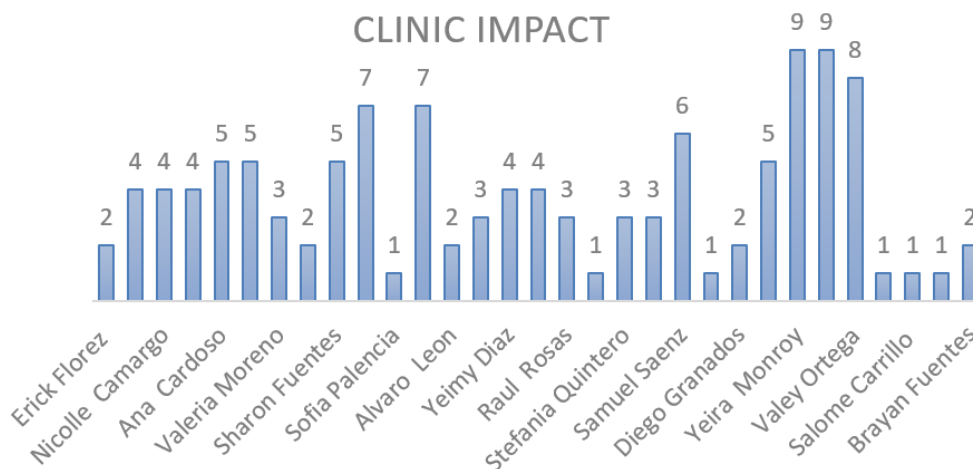


Figure 1. Mathematical clinic impact in the “Escuela Sagrado Corazón de Jesús”.

Since it appears in the previous graph the students are demonstrated by major participation in the project during 2018, in some of them is observed an average of assistance of 5 meetings, whereas some of them reach 9 meetings. In this sense the students assume it as an experience of great value for his educational process, in which they entrust and look for help. Until this point according to numbers of the educative institution there has increased in 15% the rate of approval of mathematics in the students of the degrees 4th and 5th, coming already to 85%, previously he was below 70%. Students presented an improvement in the interpretation, in the realization of operations, preconceptions, and rapid development of situations that required mental calculation, likewise improve in software use skills, solution to confusion in terms and conceptions. The Equation (1) shows a simplest model z , to standard of the mathematical clinic, a lineal combination in the sigmoid function, represented in an approximation by the l capes to $l - 1$ tranche's, i node's, according to ponderation w or differences in the importance

placed on the need for specialised expert advice and expressed to the j individuals in the time t with the assessor. On the other hand, the support provided by the psychologist allowed to improve situations of low performance caused by nervousness or beliefs in low abilities (Figure 2).

$$z_i^l = f \left(\sum_{j=1}^{n^{(l-1)}} w_{ij}^l z_j^{l-1} + t_i^l \right) \tag{1}$$

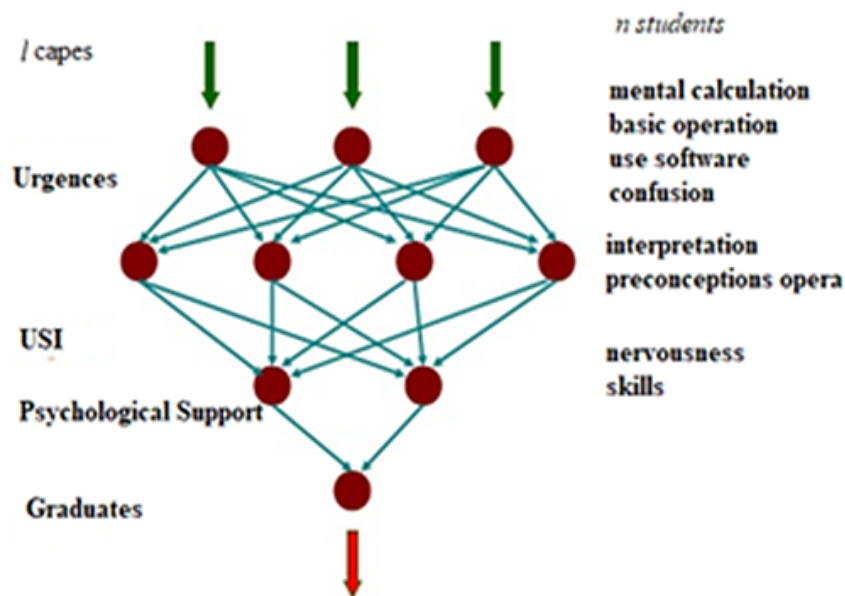


Figure 2. Neural network of the stages of the mathematical clinic.

5. Discussion

The mathematical clinic is a new space inside the Institution that allows to the students to have an academic not alone accompanying in the classroom, but also out of it, something that it generates major motivation as for the culture of learning, since now the pupils dare to ask, to consult their mistakes and to prepare their examinations. From the perspective of Curtain, it's important that the children feel motivated for learning the concepts for very complex or difficult that they should be, in this measure the scene opened from this project reflects this interest and because of it one treats that they could be as calm as possible when they are present at the advising [4]. For other part, Kieren exposes that it is necessary to stimulate the student's attention on having raised simple topics that they could identify in their daily life [12], this it is one of the values added of this initiative in which the explanations are the simplest and understandable, inside the possibilities of every topic.

The strategies of urgency and USI possess their specificities, the first one to the being voluntary his participation also it has managed to call the students' attention with academic excellence, who interested for extending their learning also go to the advising. In case of the second one on having been directed for the students who have minor qualifications, some even in danger of reprobating the school year, the pressure and the exigency is more intense because it is a question of reinforcing knowledge in brief periods of time. Nevertheless, it is not possible to think that the students who go ultimately, do not manage to expire with the aims of learning [12], since without mattering the available time, there are always planned processes in which the pupils must show with different examples, experiences, activities and exercises that have managed to assimilate the topic successfully. Likewise, it is tried the permanency of the students is not circumstantial but it returns in constant, due to its who initiate from the strategy USI, they are motivated in order to they are present regularly at the strategy of urgencies, in this sense one possesses groups that complement each other, they rest and provide in the construction of the knowledge

6. Conclusions

Exist high correlation, where the clinic has turned into a space effective learning in the institution into that students strengthened their interest for the different areas of knowledge The mathematical clinic is a model an experience that demonstrates the effective of the collective projects have when it is a question of reaching to the modernization of the educational system, especially of the Colombian, who faces several challenges as for its relevancy curricular and the performance of the students opposite to the competition showed by other countries, leaders in the educational sector. With these initiatives improvements are achieved in the numbers, while there is increased the motivation and the commitment of the students.

The current learning strategies must narrate a history, transmit the basic concepts from new perspectives, thence, the importance of possessing this 'clinic' and that the pupils sit down in a new space, even when they continue being in the same institution. In the joint of the classic thing with the current thing it is where significant offers are constructed for the enrichment of the academy.

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