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Influence of the physic-methodological model on the deaf youth

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Influence of the physic-methodological model on the deaf youth

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Abstract. The objective of this article was to evaluate the influence of the physics and urban, methodological model on the development of physical-mathematical thinking in deaf students based on research in context. Through a scale of 20 items applied to a population of 120 young deaf people between 15 and 18 years old. Factor analysis showed dimensions of pedagogical practice oriented and associate with physic thinking, variational, logical reasoning and axiomatic structure, emotional satisfaction, creative attitude, productivity, leadership competencies, motivation; internal consistency of the instrument was adequate (Cronbach alpha 0.81-0.95), a global intraclass correlation coefficient of 0.97 (95%), average differences in sum of items -1.1 (standard deviation 5.5). Physics and Urban influenced the development of physical-mathematical thinking in deaf youth in the context of "San José de Cúcuta, Colombia".

1. Introduction

Physic and urban is an area of learning that the young person contextualizes in all their activities in and out of school [1], particularly in the deaf youth whose development of mathematical thought is oriented to the visualization and need of expression with high skills in motor development [2]. In any environment, implementing data and sound through vibration, it is easy to implement didactic tools in which students put into practice the notions of measuring, comparing, counting, relating, abstracting, and others that are basic complement of physic [3]. For this reason, the teaching of this area is currently the premise that defines one of the roles of the teacher, by the application in different activities that the student carries out when relating to his environment (technical aids feel the vibrations produced by music on stages such as the open-air shopping center, or the noises of cars, through your body measures of terrain, inventories of trees, species, soil characteristics, type of use and habitat, volumes, capacities of containers, others) [4].

The article analyzes the impact of the methodological model which includes the pedagogical strategy developed through phases of research and strategies of the methodology for the development of creativity, links the analysis of the city from the understanding of codes and urban realities through a physic diagnosis that correlates the variables studied and is oriented to the deaf population, the strategy applied to the design workshops of architectural projects with the aim of strengthening the contextual basis from the analysis of urban information that technically argues the decisions of the student in the presentation of his proposal for an urban-architectural solution [5]. This article includes the model, its phases and analyzes its influence on deaf youth, shows an academic space where the student experiences and analyzes from practice and field work the reality of the city on a controlled urban scale [6], investigating the information of problems, urban elements and indicators, geometries, physic and architectural and social patterns, among others. The findings of this information evidenced by information gathering instruments are processed with Information technologies that allow to visualize in an organized way the results and patterns of change consolidating a system of random data source premium for decision making, argumentation and projection of new urban and architectural alternatives coherent with the reading of the place object of study.

2. Method

Research bases its methodology from the praxis of the mixed approach; from the quantitative, the research follows a quasi-experimental design of field type, The sample is constituted by a group of 120 students of the seedbeds in optimization and applied mathematics (SIMAO) and analysis of variance (Anova) of the basic and secondary education institutions and of the programs of architecture and degree in mathematics, to whom are oriented modules in physics and applied mathematics which will be called group A; from the qualitative approach it makes use of the postulates of an action-participant research methodology, which includes the fulfillment of a series of phases for the completion of proposed objectives. In this regard, Marti, states that the design of these phases [7] and their duration vary according to each context [8], identifying the following axes for the development of the action participant where the first axis, the delimitation of the objectives and routes to work in the urban intervention that respond to the detection of certain symptoms or antecedents. There, the teacher orients the guidelines of work in the classroom, creates a classroom environment where hypotheses of work are proposed in the sectors of the city to intervene [9], the variables object of study in the urban topic are prepared and instruments of information collection are organized such as the characterization card to be applied in the sector object of study, the respective field visits are made and information is collected.

In this first phase, the student selects the sector of the city to be studied, is accompanied by a listener and an interpreter, draws its borders and delimits the area to intervene, performs field work to observe, identifies urban variables and determinants of the context for the collection of systemic information of urban data using as a record the characterization card as an instrument proposed to tabulate data [10], and students use technical aids, using their senses, to analyze the vibrations produced by music on stages such as the open-air shopping mall, or the noise of cars, through their body. To this goal, the student proposes technological tools to collect the data, such as the use of electronic devices with applications of geographic location systems, and links software that allows him/her to accurately record the real reading of the observed urban elements.

The second stage of "opening" analyzed other existing aspects around the problems and objectives outlined. In this stage, the students, starting from the different field visits, construct qualitative and quantitative analysis with the data tools that allow them to register the information of the sector of the city intervened or its inhabitants, as well as use tablet to draw, express ideas to interviewees in order to collect possible proposals that come out of the participative praxis itself and that can serve as a basis for their debate with the social actors involved. It includes phase 2 of codification and geometrization of the urban data, the student makes analysis of the information previously collected, makes models or representational diagrams to geometrize and obtain codes on the reading of the urban dynamics from the identified variables with the help of specialized software that allows him to draw his maps or layers of the sector object of study. It is designed in this phase the survey according to emerging category of observation, which obtained a Cronbach alpha of 0.92 indicating that the scale is homogeneous [11], a scalability coefficient of 0.14 indicates non-cumulative scale [12], showing reproducibility of the instrument for decision making.

The relationships give rise to the "closing" stage, in which the proposals are concretized with the visualization of analysis, calculations are made to the variables studied and urban indicators are created that geometrize the data and emerging information of the city sector, the students group A, involved assume a leading role in the development of the process relying on technology to understand and analyze the information [13]. The teacher offers alternatives of specialized software for the statistical analysis of the data and the characterization of the information. It includes phase 3 of the urban calculation and its indicators.

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Here the student performs analysis for the identification of qualitative and quantitative urban indicators, patterns of change in the projected geometrization and a parameterization of this information from the relationship of the multiple urban and physic variables studied, which define design concepts and criteria as a premise to the possible alternative solutions to the urban problems detected. The student uses specialized software of management and control of data systems to generate the urban indicators.

The implementation of these actions opens a final cycle in which new symptoms and problems will be detected, the student takes a critical position with respect to his understanding of urban reality and proposes spatiality's as alternative solutions from the analysis and calculations raised, which allow him to define new objectives to address and evaluate the new urban development to propose evidenced in the log of the process of urban-architectural design. It includes phase 4 of the pedagogical strategy with the project production. In this phase the student represents the design criteria through the materialization of spatial approaches resulting from the process of understanding and progressive analysis of the parameterization of urban indicators. It is an evolutionary process that is built by modifying the projection from the control of the variables studied for the possible options of architectural product, which records the advances in the memory or design log. Finally, a post-test is applied to the students and variance analysis is applied, fisher test to determine if there are significant differences between groups before and after implementing the pedagogical model.

3. Results

The qualitative stage indicates eliminating from the methodology the repetition of diagrams, since it generated demotivation in the deaf young people; linking the figure of interpreter in the first visits in particular in young people of 15 years since it brought them security, and the use of technology for the field visits. The analysis is done through led as a system to interpret the sound (tone, rhythm and volume) and converts them into light as a form of language, the form of communication. The imposition of elements to develop the ability in the manipulation of forms or objects mentally, development of physical thinking, starting from the perceptible vision to create a spatial representation limit the development of the intelligence of the students with which they are born and dispose throughout life ($p > 0$). Obvious skills in observation were the detailed recognition description of the place, included the perception of objects in their entirety and as units, describes objects by their physical appearance and classifies them on the basis of similarities or global physical differences between them.

The analysis development of numerical thinking by representing physical elements (functions, vectors, operators) by means of real (or complex) numbers allowed them to master the operations established and allowed for and giving meaning to the physical quantities represented includes in them objects formed by parts and endowed with properties, identifies the relations between physic, geometric constructions, properties and axioms, describes the objects in an informal way by means of the recognition of their components and properties, makes logical classifications, likewise 40% of the young people managed to make logical classifications (abstraction) of the objects and discovers new properties based on existing properties or relations and by means of informal reasoning, describes the figures in a formal way; 35% respond adequately to deduction, make formal logical reasoning, understand the axiomatic structure and arrive at the same result from different premises, create prototypes, constructions and architectural designs including components and innovative material. students perform treatment of mechanical systems enhancing their development of spatial thinking, in the same way they master magnitudes and quantities in general, as well as their measurement and their equivalence in the different metric systems.

Random thinking associated with decision making in situations of little ontological certainty of their evolution, due to causes such as lack of reliable information, where the young observer establishes criteria for measuring and observing systems, from the probability of increasing or decreasing the intensity of light, improving the transformation, generation of models, changes of variables, movements and indexes, thus incorporating them from the variation thinking to recognize, perceive the variation and change in different contexts, urban culture, as well as with the modeling, synthesis and representation, skill in physical science.

Tukey's non-additivity test [14] confirmed the additivity of the scale ($p > 0.05$), in variables immersed in tests to identify skills and development of thinking are associated with variation thinking, movement, sound intensity, numerical thinking, random thinking, metric, geometric, spatial. presented internal consistency of 0.87 and internal consistency of 0.8 in formal logical reasoning, 0.9 in informal logical reasoning, 0.7 in axiomatic structure, 0.9 in creative attitude, 0.95 in motivation. Complete information was obtained on the evaluation of the development of the geometric thought of 120 young people. Among these groups there were no significant differences according to age ($p = 0.382$), schooling ($p = 0.89$), with greater predominance of women among cases ($p = 0.01$).

In bidirectional combined effects model where the effects of people are random and the effects of measures are fixed, the correlation coefficient is shown superior to 0.71, Fisher F = 90.011 p-value equal to 0, showing acceptable reliability for single measures and high for average measures. For equivalence, goodness test of fit model of parallel forms, chi-square of 40.6, variance 0.5; correlation 0.81; reliability scale 0.88; reliability without bias 0.89, coefficients of correlations between classes type C using a definition of coherence. Significant correlations were found between the different tests, so exploratory factor analysis was also performed, confirmed by Bartlett's sphericity test ($\chi 2 = 1717.9$; $p = 0$), Kayser-Meyer-Olkin (KMO) [15] index (KMO = 0.872). Regarding facial validity, the suitability of the content shows an instrument that complies with parameters of clarity (IC = 0.8), precision (IC = 0.9) and comprehension (IC = 0.8).The pedagogical strategy immersed in the model evaluates the proposals presented by the students to evaluate the competencies developed in the students which measures dependent variable development of geometric physical thinking from development of competencies of variables thinking numerically, metrical, randomly, variably, spatially, based on the results from the performance project components, the factorial analysis, which the first formal logical reasoning factor determines the 96.05 of the performance variability, constituting the main factor of the data analysis. Average differences in sum of items -1.1 (deviation standard 5.5) and Kappa indexes higher than 0.8, shows high agreement among experts [15]. The correlational analysis of the results in minors was made using the Kendall Tau b correlation coefficient, and the conclusions were given under a level of significance of 0.05. The correlational analysis of the results in minors was made using the Kendall Tau b correlation coefficient, and the conclusions were given under a level of significance of 0.05.

The analysis of context and the development of prototypes and constructions presents statistically significant correlation with formal logical reasoning ($p < 0.01$), architectural designs present positive correlation with creative attitude ($p < 0.01$), interpreter accompaniment is associated with critical attitude in argumentation, use tablet and other TIC is associated with emotional satisfaction ($p = 0$), development of logs and average had high correlation with axiomatic structure ($p < 0.001$). A relationship ($r = 0.6$) is observed with the other variables that evaluate thought development, although not significant. When comparing pretest and posttest results before and after implementing the model as shown in Table 1, it is observed that, Fisher's exact test produces a p-value of 0.712. Since this p-value is greater than common levels of significance (α), the null hypothesis cannot be rejected. That is, there is not enough evidence to indicate that age affects influenced the development of physical-mathematical thinking. With a larger sample, it is likely that you can demonstrate a difference Fisher F = 0.427, with p-value p = 0.7 in t-student testing to verify the null hypothesis of equality of means (Ho: changes before and after training are equal) the statistic t = 2.243 and corresponding p-value p = 0.041, so Ho is rejected, i.e. there is a significant difference the development of physical-mathematical thinking in deaf young people when implementing the pedagogical model.

Table 1. t-test for difference between means.

	F	p	t	p
Physical-mathematical Pre-Post	0.427	0.712	2.243	0.041

4. Discussion

Analyzing the impact of the application of the model on deaf students, the object of study shows results similar to youth with a wide auditory spectrum [16] but includes in this the use of tic as the primary and motivation as an influential variable in the development of geometric thinking. Students perform treatment of mechanical systems enhancing their development of spatial thinking, master equivalence of metric systems, establish criteria for measuring and observing systems, from the probability analyze intensities of light, improving the transformation, generation of basic models of movement associated with Newton's laws, changes of variables, movements and indexes[17], thus incorporating them from the variation thinking to recognize [18], perceive the variation and change in different contexts, urban culture, synthesis, representation in the study of physical phenomena [19]. The essays presented by the students in front of the geometric parameterization of data in semantic analysis-frequency of words, with a semantic structure importance of geometrization and physic-mathematical) shows the importance that gives to the data, for the design, the form, the project in architecture and in the personal scope. For them, geometrization allows them to analyze the place, the architectural space as an important process of study of the city. In this way, the emerging categories referred to data, architecture, are detached from the importance of geometrization in physic [20].

The diagram of relations between emerging categories, pointed out direct and mutual relation of learning between teacher and student, from the generation of projects that have for object the study of the city, the drawing, the projection and prospective of the public and urban space, the architecture and geography of a place, it through the collection and analysis of data in a determined time that permeates and promotes the design based on a real analysis and allows the generation of innovative interventions of the public space. All this allows the student and teacher to understand and change or transformation of architecture and its management, considering the analysis of multivariate data indispensable as an effective tool in the invention.

The application of the pedagogical proposal physic and urban, is important for the student as a scientific and reliable research tool, it is also important for urban planners, since it offers to recognize the theoretical elements argued in analysis of urban data that will justify their proposals, in search of improving their conditions and qualities starting from the analysis of the geometric visualization of the sectorial urban realities. The above, brings as a consequence the social projection of the university Francisco de Paula Santander and institutes of the region, with the formation of deaf youth and university professionals critical participants and actors in the planning of the city, offering to the authorities of government proposals that manage to glimpse from their policies and programs a true solution to the problem, analyzing the urban and social changes present in other cities.

5. Conclusions

Students develop conceptions of acoustic power, amplitude (sound), sonority from their experience with led tools, develop skills, competences and physical-mathematical thinking. Factors associated with the development of physic thought in deaf youth were pedagogical practice oriented to logical reasoning and axiomatic structure, emotional satisfaction, creative attitude, productivity, leadership competencies, motivation. There is a significant difference in the development of physic-mathematical thinking in deaf young deaf people when implementing the pedagogical model.

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