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Theoretical-Empirical Fundamentals of Programa Evolutivo Instruccional Para Matematicas (PEIM)

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Abstract

PEIM (Programa Evolutivo Instruccional Para Matemáticas) is a constructivist intervention program intended for improving students' mathematical skills. It is based on four fundamental pillars: Students are the protagonists of the classroom and construct their own mathematical knowledge. The teacher guides and facilitates students' mathematical knowledge construction. He is a great connoisseur and respects the students' process followed to learn each of the most significant school mathematical contents i.e., strategies, errors, etc. The use of individual mathematical profiles turns out to be very useful. Mathematical contents should be selected and sequenced according to their difficulty, avoiding, as much as possible, the rote and mechanical tasks and always looking for meaningful situations for students. Finally, the classroom climate must be constructivist, highlighting each student's cooperative work and independence in the construction of their own knowledge and using materials that facilitate their learning process. The implementation of PEIM highlights its effectiveness not only in solving problems, but also in choosing more advanced strategies to solve problems and notoriously reducing the conceptual errors. It should also be noted that students' mathematical performance appears in relation with the teacher's level of acceptance and application of the constructivist approach in the classroom.

Keywords: Mathematical contents • Programa evolutivo instruccional para matemáticas • Theoretical-empirical fundamentals

Introduction

In early 2021 Frontiers in Psychology Journal published an extensive and detailed research paper written by the above-mentioned authors with the title: "A Constructivist Intervention Program for the Improvement of Mathematical Performance Based on Empiric Developmental Results (PEIM)". It is a model that aims to improve Spanish schoolers mathematical performance, which is usually quite mediocre according to national and international evaluations (see, for example, PISA rating). This model has its roots, from the epistemological point of view, to Gorgas and Plato, through Descartes, Berkeley, Vico, Leibnitz, Kant, etc. In the 17th century, Rousseau wrote in the Prologue of his book "The Emile": "Study your students, because surely, you do not know them". And even earlier, in the 16th century, our compatriot Luis Vives suggested that students should be evaluated when they are about to start school life to be aware of their level of development. However, the father of cognitive constructivism was Piaget, as it appears in his book. It was within this theoretical framework that Professor Bermejo was trained during the seventies. He was one of Piaget's students and worked as a professor at the University of Geneva.

We would like to highlight some key ideas that define the present model: "you only learn what you understand", "the child constructs his own knowledge" or "the instruction guides the construction of knowledge in the child" or finally, "the instruction focuses on understanding and solving problems". Likewise, from this perspective, both the students' and teacher's constructivist profiles will easily emerge. On one hand, concerning the student, we propose that the child constructs his own knowledge and is the protagonist in the classroom; he is manually and mentally active and autonomous and independent enough for his own knowledge construction. On the other hand, the teacher's constructivist profile assumes that the student is the protagonist in the classroom and that learning mathematics is based on the understanding of procedures and problem solving; and schoolers have prior knowledge before class instruction. Moreover, the teacher's attitude is active, listening to and asking his students; a personalized interaction with students is advised.

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Review of Literature

PEIM is a constructivist model of intervention in the classroom based on four pillars: a) the students, b) the teacher, c) the school contents and d) the social climate of the classroom [1,2].

In first place, as far as students is concerned, they build their own knowledge taking into account their previous development restructuring the new context and using, if necessary, their creativity and alternative thoughts [1,3]. In any case, it is important that students construct their own knowledge through meaningful learning closely related to their extracurricular life, as it is pointed out by the National Council of Teachers of Mathematics: "students should learn mathematics by comprehending, actively building new knowledge from experience and from their previous knowledge" [4].

Concerning the second pillar, the teacher, it is essential that they know not only the mathematical contents taught in class, but also how the student learns each mathematical content, the mistakes they usually make and the strategies they usually use. It is worth reminding the importance of mistakes as a source of learning [5].

For this reason, it is essential to carry out empirical studies on how and when children learn and acquire the main mathematical contents. In order to accomplish it, Professor Bermejo and his team have carried out more than forty empirical investigations with boys and girls of different ages (four to eight-nine years) on the most significant school mathematical contents. With these data, the teacher will be able to elaborate and use each student's mathematical profile, not only to know their precise developmental level, but also to anticipate and organize the most appropriate learning moment for each student to build his own knowledge on mathematics [5-7]. Nevertheless, negative attitudes towards mathematics are relatively frequent among the adult population and even among primary school teachers which does not facilitate the complex teaching-learning process [8-11]. In this case, it would be advisable to modify the teachers' negative attitude towards mathematics, highlighting, for example, the importance of mathematical knowledge in kids' daily lives.

PEIM's third pillar refers to school mathematical contents, which must be selected and sequenced appropriately, in order to reduce mechanical

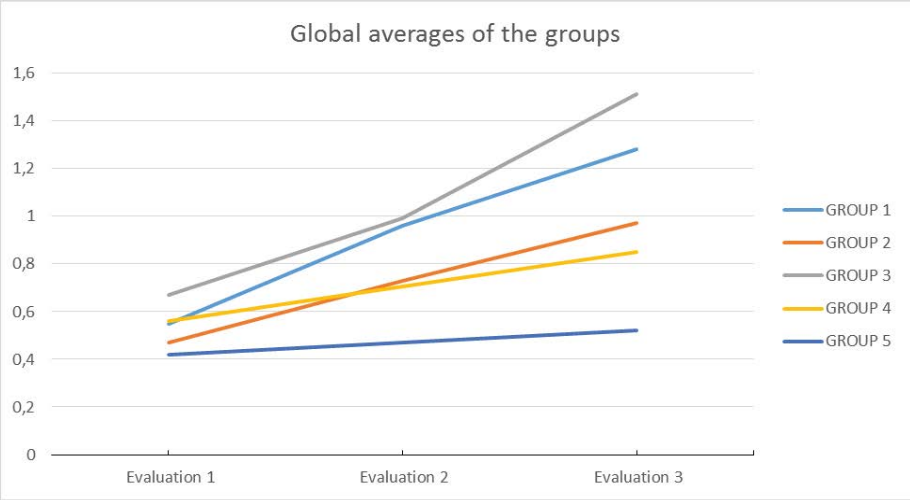

Figure 1. Global averages PEIM in classrooms of different schools.

and routine activities, increase understanding, reasoning, problem solving, decision-making, etc. and give meaning to related learning with everyday life. In addition, contents must be sequenced according to their difficulty level. To do so, we carried out micro genetic empirical studies that allow us to know the developmental steps that children follow in learning mathematical contents, surpassing the information that Piagetian macro-stages could provide us with.

Finally, the classroom context constitutes the fourth pillar of the PEIM. Discussion between students in the classroom and cooperative work will benefit both the more advanced students and those with learning difficulties .Following the same dynamic, we can differentiate among several models depending on the students' age, since this discussion can be promoted between students of the same age (among peers) or of different age . Regardless of the model we choose, we can see how the exchange of ideas between equals improves the students' academic performance. This is reason why PEIM stands up for a classroom dynamic in which students, in order to solve the tasks proposed, work cooperatively. These tasks should be as close to the real world as possible, which will allow the student to be able to transfer their learning to their life and move away from rote and repetitive learning.

The implementation of PEIM in classrooms of different schools shows that the experimental students obtain significantly better results than the control groups, as it is shown in Figure 1.

Conclusion

Likewise, we observed a close and positive relationship between the teachers' acceptance level of the PEIM and the students' mathematical performance. Furthermore, in traditional teaching, the mathematical knowledge acquired outside the classroom is rarely taken into account. This situation sometimes leads to a kind of 'schizophrenia' in kids between classroom mathematics and daily-life mathematics. In order to avoid this situation, it is convenient to bring daily-life mathematics into the school and frequently contextualize and give meaning to learning mathematics.

References

1. Bagassi, Maria, Nicoletta Salerni, Valeria Castoldi and Laura Macchi, et al. "Improving children's Logical and Mathematical Performance *via* a Pragmatic Approach." *Front Psychol 5* (2020): 54.
2. Bermejo Fernández, Vicente, María Oliva Lago Marcos and Purificación Rodríguez. "Aprendizaje De La Adición Y Sustracción: Secuenciación De Los Problemas Verbales Según Su Dificultad." *Rev psicol apl deporte ejerc fis* 51 (1998): 533-552.
3. Bermejo, Vicente. "PEI un Programa De Intervencion Para La Mejora Del Rendimiento Matematico/Pei an Intervention Program to Improve the Mathematical Performance." *Editorial Complutense* 15 (2002).
4. Bermejo, Vicente. *Cómo Enseñar Matemáticas Para Aprender Mejor Texto Impreso*. en Casa del Libro, (2014).
5. Bermejo, Vicente. *Cómo y cuándo el niño aprende las matemáticas. San José.* Construyendo puentes entre Universidad-Escuela, (2018).
6. Bermejo, Vicente, Pilar Ester, and Isabel Morales. "A Constructivist Intervention Program for the Improvement of Mathematical Performance Based on Empiric Developmental Results (Peim)." *Front Psychol* 11 (2021): 3784.
7. Moliner, Lidón and Francisco Alegre. "Peer Tutoring Effects on Students Mathematics Anxiety: A Middle School Experience." *Front psychol* 11 (2020): 1610.
8. Martin, W Gary. "Principles and Standards for School Mathematics." *National Council Teachers* 1 (2000): 1-5.
9. Piaget, J. La construction Du Réel Chez Lenfant, *Delachaux et Niestlé* , France, (1937/1967).
10. Sarid, Miriam, Yael Meltzer, and Michal Raveh. "Academic Achievements of College Graduates with Learning Disabilities Vis-A-Vis Admission Criteria and Academic Support." *J Learn Disabil* 53 (2020): 60-74.
11. Valentine, Keri D, and Johnna Bolyard. "Lived Moments of Shift in Prospective Elementary Teachers' Mathematical Learning." *Math Educ Res J* 50 (2019): 436-463.

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