

Didactic and disciplinary knowledge of elementary school teachers in training for redesign of teaching situations on the meanings of fractions

María del Carmen Fajardo Araujo ¹ 

What problem is addressed?

Research on learning fractions dates to the 1960s, the literature reports extensive studies about obstacles students face when learning fractions (Lamon, 2020; Solares & Block, 2001) and the didactic sequences that teachers use to teach fractions (Ávila, 2019; Block, 2022a, 2022b), but in the Mexican context there is little research on how the teacher in training designs, assesses, and redesigns activities to teach the diversity of fractions meanings that the basic education curricula stipulate. Therefore, this study aims to delve deeper into the didactic and disciplinary knowledge of future elementary school teachers, so that recommendations can be made regarding the strengthening of these didactic tools for understanding, adapting, designing, evaluating and redesigning situations involving fractions. The theoretical perspectives including references to recent curriculum (Secretaría de Educación Pública [SEP], 2022) for initial training of elementary school teachers in México that analysed with two complementary directions, first the content knowledge (mathematics) and

¹ maria.fajardo@normales.mx

Departamento de Investigaciones Educativas, CINVESTAV, Ciudad de México, México

Fajardo Araujo, M. C. (2026). Didactic and disciplinary knowledge of elementary school teachers in training for redesign of teaching situations on the meanings of fractions. In M. S. Aguilar & M. Misfeldt (Eds.), *Proceedings of the First Implementation and Replication Studies in Mathematics Education Conference: IRMEC 2025* (pp. 181–184). Editorial SOMIDEM. <https://doi.org/10.24844/SOMIDEM/S3/2026/03-27>

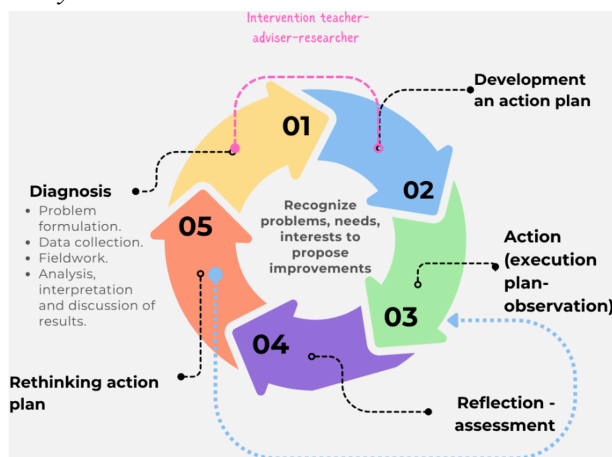
second the pedagogical knowledge. Throughout the educational Mexican reforms for the training of primary school teachers, it has been observed that the programs have reduced the number of hours dedicated to specific mathematical content such as fractions, which in the current program (2022) only one unit of approximately 24 hours per semester is devoted to matters related to fractions. Several researchers (Shulman, 1986; Ball et al., 2008) agree that the teacher must have disciplinary and didactic knowledge about what they are going to teach, in this case fractions. The content knowledge refers to mathematical knowledge. The didactic aspect has to do with the appropriate didactic transposition of mathematical knowledge.

How is it addressed?

From a qualitative approach we aim to explore the didactic and disciplinary knowledge that trainee teachers bring into play when assessing situations involving the meanings of fractions as ratios, measures, quotients, and decimals (Kieren, 1980). The participants are nine students who are in the final year of their degree to become an elementary school teacher. The instruments to collect information were interviews, lesson plan, class observations, reflective writings, and a diagnostic interpretation questionnaire. We are using the case study (Stake, 1995/1999) and the action research cycle (Elliott, 1993) to promote reflective actions in the future teachers. Figure 1 shows the process that has been implemented.

Figure 1

Action research cycle and researcher intervention



What is implemented?

The starting point was a diagnosis of fractions; the items considered meanings of fractions as part-whole, decimals, measurement, number line

and were taken from Mexican textbooks. Because the diagnostic questionnaire interpretations of the children's responses were ingenuous, the decision was made to suggest some specialized literature about didactical fractions, so that it would help them in designing a first intervention proposal (second step of the action research cycle or lesson plan). Subsequently the future teachers applied and observed the lesson plan activities to reflect on, assess, and rethink the lesson plan, thus beginning a new cycle.

Some results from this first stage of research indicate that they have problems with the mathematical content on fractions. Although the interventions or spaces for reflection carried out with the future teachers mobilized some knowledge (mathematical and didactical), some of them expressed confusions such as partitioning with sharing and some of them prefer the teaching of fractions in a traditional way, starting with concept, the definition and exercises.

What is the potential importance and significance?

The first results show problems in two aspects: mathematics and didactics. It is recognized that research recommendations on how to teach fractions at the elementary level were not enough; other types of interventions are needed, perhaps the analysis of more specific tasks that allow for more effective lesson planning and avoid the reliance on the circle as the only graphic way to work with fractions. One goal of this project is to propose a route for redesigning situations that include teaching and disciplinary elements and analysis that allow future teachers to assess and improve the relevance of their proposals. The possible path to achieving this lies in interpretative knowledge (Ribeiro et al., 2016), which is expected to yield results in future work.

Acknowledgments

Thank you to DIE CINVESTAV and SECIHTI for funding this research project and David Block Sevilla for reading and collaborating in this research.

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