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MATHEMATICS LEARNING OPPORTUNITIES FOR STUDENTS WITH INTELLECTUAL DISABILITIES IN CHILEAN SPECIAL SCHOOLS

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Abstract

In Chile, students with learning disabilities (LD) go to special schools or to mainstream schools with Integration Programmes. Even though there are data regarding the access of students to the educational system, there is not much knowledge related to the learning opportunities (LO) that these students are given. In this context, a multiple case study was developed, aiming to explore the learning opportunities in mathematics that are created within special education centers. This work presents the findings of the analysis of interviews to teachers and principals, as well as the findings of the analysis of the classroom materials of three cases, in terms of the type of cognitive demand and the curricular coverage of the mathematical tasks performed in notebooks and textbooks in the span of a semester. As shown in the results, teaching LD students must be focused on the development of the concept of number, as well as basic operations, aiming to use money in the community. Activities developed in special schools feature a low level of cognitive demand and the repetitive use of the same type of tasks

Keywords: Learning opportunities, intellectual disability, cognitive demand

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1. Introduction

One of the main problems for the theory and practice of mathematics education is equity (Forgasz & Rivera, 2012), especially if we come to the understanding that equity cannot happen without access to this education (Bishop & Forgasz, 2007). This is why in the research on equity in mathematics education, finding how students access to the learning goals of the curriculum gains more importance, and particularly, those students that are at risk of being excluded whether due to personal of contextual conditions, which is the case of people with learning disabilities (LD) (Ainscow, Booth & Dyson, 2006).

In Chile, LD students go to special schools or to mainstream schools with Integration Programmes. Even though there are data referring to the access of students to the educational system, there is no much knowledge regarding the Learning Opportunities that these students are given. In this context, this work presents the results of a bigger research (Howard, San Martin, Salas, Blanco and Díaz, in press), whose main goal is to know and describe the LOs in math produced in special schools for LD students. The research shows the results derived from the analysis of classroom material (notebooks and textbooks) and from semi-structured interviews to the teaching and management staff of Chilean special schools.

Mathematics provides students with the language that allows them to interpret, describe, analyze, predict and solve everyday problems. Even though the learning objectives of the mathematics curriculum are established for the whole universe of students, international studies have shown that LD students do not have access to high educational quality mathematics programs (Gervasoni & Lindenskov, 2011). The research has clearly stablished that a high amount of these students are deprived of the chance of learning mathematics, because it is considered an inadequate field of study for them (Faragher, Brady, Clarke & Gervasoni, 2008).

The abstract and conceptual nature of mathematics raises particular challenges to LD students, especially in problem solving. Therefore, these students require a large variety of actions that help increasing their learning opportunities (Sarama & Clements, 2009).

One way to study the access of students to the learning that they receive is through the concept of Learning Opportunities (LO). The LOs were originally defined as a measure towards the possibility of studying a particular subject, or learning how to solve a determined type of problem given in an evaluation (McDonnell, 1995). Later on, the LOs were broadened towards the supply of proper opportunities for every group of students, including the analysis of resources, school conditions, the curriculum and the teaching experiences (Banicky, 2000). Schmidt and McKnight (1995) have indicated that the LOs analysis may inform the distance between the designed curriculum and the one that is actually implemented, and that the LOs depend, among other factors, on variables that are associated to teachers, the characteristics of students and the school (Howard et al., in press)

The international studies that have sought to explore de LOs have been performed through different techniques, such as questionnaires aimed to teachers (Cogan & Schmidt, 2015; Schmidt & McKnight, 1995) and analyses of the notebooks of students (Ruiz-Primo, Li & Shavelson, 2001). These analyses have allowed the development of a fuller approach to the LOs, since it provides information regarding the processes through which teachers develop a given objective, besides including contents and skills. Thus, the study of the notebooks of the students allow the identification the type of mathematical task, the skills involved in the proposed activities, and it also allows to analyze the cognitive demand

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(Stein, Grover & Henningsen, 1996) of the type of task, and therefore, the LOs that teachers give to their students. The level of cognitive demand of a given activity refers to the type of cognitive processes the student requires to fulfill it. According to the Stein et al. (2000) taxonomy this level may vary within a continuum of four increasingly complex levels: memorization, offline procedures, on line procedures and "do math". These studies have remarked the importance of the activity of teachers in the generation of opportunities of learning through the selection of tasks and mathematical activities (Sullivan, Clarke, Clarke & O'Shea, 2010), due to the influence of their perceptions and the objectives that underlie their actions and decisions (Carrillo, Contreras, Zakaryan, 2013) in the LOs of students (Sullivan et al., 2010). In this regard, the analyses of the characteristics of teachers, particularly their beliefs, have garnered increasing interest, given their influence in the pedagogical practice (San Martín, 2012; Thompson, 1992).

Regarding the theoretical development of the beliefs linked to mathematics, three dimensions have been identified (Schmidt & McKnight, 1995): beliefs on mathematics as object of study, beliefs on the nature of teaching mathematics, and beliefs regarding the learning of mathematics.

In this scenario, the present work shows the partial results of a bigger research, which seeks to answer the question, what opportunities are provided in special schools for students with intellectual disabilities to develop the learnings defined in the national mathematics curriculum?

2. Problem Statement

There is a lack of systematic studies regarding the learning opportunities provided to students with intellectual disabilities attending special education schools

3. Research Questions

What opportunities are provided in special schools for students with intellectual disabilities to develop the defined learning in the national math curriculum?

4. Purpose of the Study

Know and describe learning opportunities in mathematics that are given in special schools for students with intellectual disabilities

5. Research Methods

This research used a multiple case study design (Yin, 1994) through two elements: a record of the classroom material and semi-structured interviews.

Three cases were studied. Each of them correspond to a first basic cycle mathematics course from different special schools in the Chilean Metropolitan Region.

In each case, the work material (notebooks and textbooks) of the first semester was collected from four students from three first basic cycle courses through images In addition, the teacher of each of these courses, the technical pedagogical coordinator and the principal of each school were interviewed. Nine interviews were conducted in total. An analysis of the content of every activity/exercise registered in

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notebooks and textbooks was performed, which covered two aspects: i) the identification of the learning objectives (current national curriculum) and ii) the identification of the level of cognitive demand. The codification was developed by two researchers through independent sessions and three sessions devoted to discussion and recoding. The level shown in the analysis was satisfactory, according to a statistical Cohen Kappa (k), that fluctuated between .62 and .97, being k = 85 the mean value.

The interviews delved into the description of the design, development and evaluation processes of the mathematics classes and the learning of students, as well as the meanings given by the interviewees to mathematics, its teaching and learning, specifically with LD students. Once the transcription of every interview was made, an analysis of the content was performed, through the systematic implementation of the constant comparative method (Glaser & Strauss, 2009).

6. Findings

The presentation of the results is structured in two sections. While the first one is focused on the analysed classroom material (notebooks and textbooks), the second one presents to the results of the analysis of the interviews.

6.1. Identified learning opportunities in the classroom material.

In total, 518 activities/exercises were coded, 61,8% of which (N=320) are notebook activities and 38,2% (N=198) are exercises from the textbooks of students. Regarding the level of cognitive demand of the activities that were proposed to students, 84,4% of the total corresponds to the “memorization” level (N=432); the remaining 16,6% (N=86) corresponds to the “offline procedure” level. No activity with cognitive demand in the two upper levels was identified.

Regarding the curricular coverage, from the universe of analyzed activities, 69,7% were coded within the curricular framework of first grade, while 13,7% correspond to second grade and the remaining 15,8% correspond to the transition levels of childhood education. It is worth mentioning that in each of the analyzed cases the encoded activities encompass the current Chilean curriculum for primary education, first and second grade. With regard to the abilities established in the basic education curriculum, most of the analyzed activities promote the representation skill (89,3%), while the modeling skills (6,3%) and the argue and communicate skills (4,4%) are less frequent, as shown in Table 1. Regarding the main lines existent in the total of analyzed activities, the LOs are focused on the teaching of numbers and operations (90%), while the main lines of geometry (8,9%) and patterns/algebra (1,2%) are much less frequent both in notebooks and textbooks.

From the primary level activities, most of them are also devoted to subjects related to the Numbers main line. This way, 47,3% of the activities are focused on the expected learning in terms of the recognition and nomination of the numbers, followed by activities that promote opportunities to use them (20,7%) and other activities that are focused on the recognition of attributes of geometrical figures (18,3%). In terms of the type of tasks through which LOs are given in notebooks and textbooks, a pattern of sequential teaching of the numbers was observed. Usually, these activities are: repetitive writing of the

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number, associate it with the amount of elements, writing sequences of numbers, and perform additions and subtractions with or without support of pictorial elements.

6.2. Learning opportunities identified from teachers' accounts.

The process of analysis of the interviews allowed setting a core category regarding the declared beliefs and practices in relation to the teaching of mathematics. Four sub-categories stem from it: i) teaching planning; ii) methodologies; iii) resources for teaching and iv) learning evaluation.

A generalized and shared element, present in the accounts of all interviewees, is how mathematics teaching is conceptualized, which needs to adapt and adequate in function of the characteristics of every student of the special school. Thus, there is a lingering belief that the way of answering to the different needs of the students is through a flexibility that allows facing every specific situation within the classroom, and through activities that are consistent with the learning potential of students.

Drawing from the declared beliefs and practices of the teaching and management staff, the mathematics that LD students must study are related mainly to the construction of the concept of number, aiming to develop skills to use and manage money.

> "I haven't wanted to go into the money subject yet. I have tried to go one step at the time… trying not to leave any gaps, because those gaps cost dearly afterwards. If the brat didn't get a firm grasp of the concept of number, if he wasn't able to recognize the full numeric sequence, the next year and the year after that one is going to weigh on him" (Teacher 2).

The process of teaching and learning mathematics is planned according to the decisions taken by each teacher. The selection criterion of the mathematics learning is mainly the result of the diagnostic evaluation at the beginning of the school year, which has a formative character, and according to which an annual plan is designed. In other words, the mathematics learning to be taught is selected according to the level of competences of the students.

"Then we have the process of diagnostic evaluation, in which the annual plans of work for every subject are developed, and from which the daily and monthly planning are derived" (TPU 3).

This educational plan is extensive to every student of the course, so the educational needs of students are covered on a curricular level through the softening of the same educational plan in the monthly planning designed by teachers, and through the implementation of the activity in the classroom.

There are two main obstacles that affect the design and development of diversified planning. These obstacles are the lack of no instruction time and specific characteristics shown by every condition and student (e.g. defiant behavior, poor strategies for social-emotional coping with the challenge of learning mathematics, high vulnerability contexts, among others).

"…because to plan something like this you have to be very smart; thinking how to plan demands time, and I think that nowadays, teachers spend very little time thinking about planning, which will also give you an answer in terms of the strategies you're going to use, the materials you are going to utilize" (TPU 2).

As for the methodologies used for the learning of mathematics, the interviewees express a lack of shared methodological guidelines among teachers, which reveals a degree of autonomy in teaching that is expected to be coherent with the characteristics of the students. One recurring feature mentioned by the

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interviewees is their variety and flexibility, as well as playing as a central aspect that coexists with more traditional teaching strategies.

"…each person works relying on his/her own knowledge, the particular characteristics of his/her course; there is no guideline at a school level" (Principal 1).

In terms of the resources used for the learning of mathematics, we may highlight the use of particular materials and the use of technologies. Teachers state that they use different particular materials, such as natural resources and waste materials, which are recycled to create classroom materials:

"…in the classroom… we have worked with stones… with polysterene trays… like the ones in which meat is packaged [sic], so they can get an idea of the amount" (Teacher 1)

Results show that to achieve the learning related to the numeric and operative sphere, the work is focused mainly on activities developed in the blackboard, which are either written down by the students in their notebooks, or developed in work guides.

"… (We use) the textbook and the notebook, because, thing is, I'm older now. I work with textbooks and notebooks, with guides and sheets" (Educator 3).

On the other hand, the management reference mainly to the technological resources available in schools, which are used for the teaching and learning of mathematics. The ICTs are mainly used as AV support, through presentations, slide shows and the work with mathematics interactive activities with which students work in the computer.

The main method of evaluation is a qualitative procedure (anecdotic registration, scales of assessment), and in a lesser degree a half-yearly summative evaluation, though a quantitative procedure.

"… in terms of math, we all evaluate in a different way; we first evaluate in the March process, we have the evaluation sent by the foundation… but besides that, we have tests designed by ourselves in the school" (Principal 3)

The evaluation process shows little structure and guidelines that allow to clearly state how to evaluate, which are the instruments to be applied and how to turn the qualitative data obtained through the observation instruments into a qualification:

"…we do monthly evaluations, which are scale of appreciations according to the observations we make within the classroom… for instance, in April, we worked with a scale from 0 to 9, and evaluated either with a multiple-choice or a written explanation test. Besides that, we also give homework" (Teacher 1).

7. Conclusion

The current work explored and analysed the learning opportunities from both the available classroom material and the declared beliefs and practices of classroom teachers and the management staff of the Chilean special schools, regarding mathematics and its teaching and learning process. To do so, a descriptive qualitative method which sought to understand from singular experiences the core aspects of the study problem was used.

Results show that: i) in these educational contexts, mathematics teaching comes up as a process that instead of adapting to the curricular demands, it needs to adjust to the characteristics and needs of the students; ii) the teaching is focused on the learning of numbers and basic operations, since they are both

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perceived as key factors for the use of money within the community; iii) the activities developed tend to be repetitive and well-trodden, with a low level of cognitive demand and that promote the development of the representing skill, and in a lesser degree, the modelling skill; iv) teaching planning is fuelled by diagnostic evaluations that help in the designing of annual course planning and its subsequent adaptation to specific student cases. However, the lack of no instruction time constitutes an obstacle these design processes must face; v) the learning evaluation is based on an individual look of the process, which is carried out through qualitative and quantitative instruments to measure half-yearly learning results. Results also show, even though not so highlighted, that the teaching methodologies are flexible and cover strategies that can be both ludic and more traditional and individual, such as working in notebooks, textbooks and worksheets; results also indicate that within the mathematics class, technological resources and particular materials are used, aiming to help in the manipulation and counting.

Results show educational beliefs and practices underpinned by the development of learning processes, which in turn are based on a restricted and less rigorous curriculum (Nolet & McLaughlin, 2000), that showcase an intensive use of particular materials (Sarama & Clements, 2009). These beliefs and practices show the need of performing individual curricular adaptations. Even though there are times when individual adaptations are needed, this stand of analysing each case on an individual basis may stem from a work logic that is very common in the cognitivist special teaching, which focuses on the particular skills without meddling with other approaches that perceive teaching and learning as a co-construction performed by each of its participants.

Results expose the limitation of the LOs given to LD students in mathematics, which in turn limits the educational equity, restricting mathematics specifically to the concept of number associated to the use of money.

Finally, it is of importance to pin down the need to develop future research to complement the results shown in this work, in order to generate guidelines for the educational practice in mathematics for LD students. It is to be expected that the sum of these elements will contribute in moving towards a true equal access to the LOs in mathematics, based on the right to quality education for all students.

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