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MEANINGS OF MATHEMATICS IN THE DISCOURSE OF BOYS AND GIRLS IN PRIMARY EDUCATION: A GENDER PERSPECTIVE

Sofía Parada-Alfaro
Catholic University of Maule, Talca, Chile
Faculty of Basic Sciences
https://orcid.org/0009-0001-5684-3563

Maria Jose Seckel
Universidad Católica de la Santísima Concepción, Concepción, Chile
Faculty of Education
https://orcid.org/0000-0001-7960-746X

Abstract: This research addresses the issue of gender in mathematics education, and its purpose is to understand the meaning attributed to mathematics education by students in the fifth year of primary education from a gender perspective. The methodology used is of a qualitative-descriptive nature and the data collection technique corresponds to a focus group that was applied with 24 students in the fifth year of primary education (10 to 11 years of age) in two public schools in the province of Talca, Chile (11 and 13 participants respectively, 50% of them girls in each school). In general terms, the data collected show a negative conception of mathematics as a difficult subject, although they recognize it as one of the most important learning subsectors and their future projections are linked to this discipline. In the analysis of the results from a gender perspective, gender stereotypes are evident in the conceptions they have about mathematics, since it is stated (girls and boys) that men have greater mathematical skills and that they have developed more capacities to develop in careers related to mathematics. However, there is evidence of positive attitudes towards mathematics on the part of girls, who trust that effort will allow them to have good results and, consequently, to opt for professional careers related to mathematics in the future.
Keywords: Mathematics education, gender stereotypes, primary education.

INTRODUCTION

Mathematics education plays a fundamental role in the development of skills and competencies necessary for daily life and professional performance; however, the perception of this area and the valuation given to it is so personal that it can vary significantly depending on social and cultural factors, such as gender (Boaler, 2002; Leder and Forgasz, 2002). These differences not only influence academic performance, but also attitudes towards mathematics and the choice of future careers related to the area of science (Ceci et al., 2014).

This article addresses the meaning given to mathematics education by fifth grade students, exploring how these discourses may be influenced by gender stereotypes. The literature has reported that gender stereotypes tend to associate mathematics with masculine skills, which can have a negative impact on the perception and motivation of girls towards this discipline (Hyde et al., 2008). In this context, it is relevant to analyze whether there are significant differences in how boys and girls attach value or meaning to mathematics and whether these perceptions reinforce or challenge traditional gender roles.

Understanding these dynamics allows not only to identify inequalities, but also to promote pedagogical practices that foster equity inside and outside the classroom. As Valero (2004) points out, the discourse surrounding mathematics education has profound implications in the construction of student identities and in the way in which individuals position themselves in relation to mathematical knowledge.

Another relevant aspect within this study is the level at which the students are, which is a transition level, from first to second basic cycle, which represents a critical moment in the academic and social formation of the students, since it coincides with significant chan-

ges in their cognitive, social and emotional development (Eccles, 1999). In this context, the learning of mathematics acquires special relevance, since at this stage students consolidate their bases in fundamental concepts and develop attitudes towards this discipline that may impact their future performance, which is why it is important to stimulate interest and confidence in academic areas such as mathematics from an early age in order to avoid possible gender biases (Eccles and Wigfield, 2002).

THEORETICAL FRAMEWORK

MATHEMATICS EDUCATION WITH A GENDER PERSPECTIVE.

Mathematics education is fundamental for the integral development of students, since it not only provides them with essential skills for everyday life, but also fosters critical competencies in the academic and professional spheres (Nunes et al., 2021). In this line, González and Pérez (2002) point out that there is a great gender difference in science, where there is a low number of women dedicated to this area, explaining, in addition, that there are obstacles that have not allowed women to excel in this area, due to the lack of public recognition of those who have made significant contributions in this discipline. One of the determining factors in the gender gap between men and women in the field of mathematics could be the teachers, since, as Flores (2007) points out, girls show a low self-esteem for learning mathematics, which could be due to the gender representations of their respective teachers and/or mathematics professors.

The gender gap in academic achievement in mathematics is a persistent challenge in education, manifesting itself in significant differences in mathematical confidence and skills among students of different genders. This disparity not only impacts female students' self-efficacy, but also has long-term implications for their interest and participation in disciplines that require mathematical skills (Bian, Leslie, & Cimpian, 2017; and Hill, Corbett, & St. Rose, 2010). Therefore, it is crucial to understand and address the factors that contribute to this gap.

Along the same lines, Farfán (2016) points out that the existing gaps are the result of stereotypes that have been present throughout life, whether in the family environment, social life or within the school system. Aravena (2020) expresses that there is a national and international concern for improving the teaching of science and mathematics, pointing out that there are several studies reporting diagnoses and proposals at all levels, including teacher training, where difficulties and obstacles are evidenced at both conceptual and procedural levels.

CONCEPTIONS AND ATTITUDES TOWARDS MATHEMATICS

It is of interest for this study to investigate this emotional dimension, related to conceptions and attitudes towards mathematics. Specifically, the interest is focused on the conceptions and attitudes towards mathematics and how these factors could acquire particular characteristics considering the gender variable.

As for conceptions, they are understood as prior ideas, which precede action (Griffiths, Gore and Ladwig, 2006). Azcárate (2003) points out that conceptions include beliefs, meaning, concepts, propositions, rules, mental images, preferences, which will influence what is perceived, and the reasoning processes that are performed. In this line, regarding conceptions about mathematics, Benitez (2013) points out that students generally perceive mathematics as an abstract and difficult to access area, which generates that it is perceived negatively towards learning, this per-

ception is influenced by previous experiences, teaching methodologies and cultural context. There are studies that point out that the conception that students have about mathematics education depends on the classroom climate and the interaction with the teacher (Hernández et al. 2019).

It is important to emphasize that the conceptions that students have about mathematics are not static, but are transformed depending on the different factors we are confronted with (Benítez, 2013).

Regarding attitudes, Gallego and Gómez (2000) point out that these can be expressed through various factors, such as: ideas, perceptions, tastes, preferences, opinions, beliefs, emotions, feelings, interests and behaviors. The explanations that an individual gives himself, of his successes and failures in school, will influence the attitude he will have towards new teaching and learning processes (Font, 1994).

Aliaga and Pecho (2000) point out that mathematical attitudes are related to student performance, since the performance of students with low interest is also low. In the same line, Coleman (2009), points out that attitudes towards mathematics are closely related to student performance, since students who are motivated and have a positive attitude towards the subject tend to make a greater effort, which increases their possibility of achieving high scores. On the other hand, it is also important to point out that teachers play an important role in the development of students' attitudes towards mathematics. Teachers, in their daily practice, must apply strategies that motivate, inspire and engage students in their own learning process. A teacher who is aware of the importance of his or her work generates well-being and stimulates motivation in students, which translates into better human and academic results (Hondoy, 2021).

Regarding the development of attitudes linked to gender, Subirats (1996) points out that teachers constantly make differences between men and women, assuring that women are gifted for language and men for mathematics, these differences would be influenced by socially dominant gender stereotypes, which have been internalized and unconsciously reproduced. In this line, the University of Chile (2016) conducted an observational study of mathematics classes where teachers, regardless of gender, asked more mathematical reasoning questions to men than to women.

METHODOLOGY

The research approach is of a descriptive qualitative nature (Hernández, Férnandez and Baptista, 2014). Likewise, in order to achieve the research purposes, a multiple case study design was followed, consisting of two groups of 5th grade elementary school students.

CONTEXT AND PARTICIPANTS

The study involved 24 students in the fifth year of primary education from two public schools in the Maule Region, Chile, whose ages ranged from 10-11 years old.

The students selected were from the fifth year of elementary education because, being in a transition process, it was attractive to know the visualization they could have about mathematics classes and the teachers who teach this area of knowledge, since these students from the first to the fourth year of elementary education had a teacher who taught all the subjects, However, since 5th grade they have had specialized teachers in each area of knowledge, which generates a different and interesting experience to know in depth, since the background information shows that in the last levels of basic education there is a tendency to decrease the attitudes towards mathematics.

COLLECTION TECHNIQUES AND ANALYSIS OF RESULTS

For data collection, a Focus Group was designed with a script of questions that was validated by expert judges and considered three dimensions.

1. Conceptions about gender in mathematics. School environment and teaching role

2. Gender and purpose of mathematics learning.

3. Attitude and ability towards mathematics and related areas in a gender perspective.

The focus group was implemented with two groups with 11 and 13 participants respectively, each group belonging to different educational establishments. It should be noted that the participation had the informed consent of the adults responsible for each participant and the assent of the participants.

Based on the discourse, which was recorded by audiovisual recording, transcriptions were made of the information provided in order to categorize the units of analysis. In this way, in the categorization process, inductive categories and sub-categories emanating from the discourse of the participants were considered.

RESULTS

The data show that five categories emerge from the discourse of the participants and three of them with their respective subcategories, as shown in Figure x.

With respect to the category "Mathematical skills are masculine", it is observed that both girls and boys tend to consider mathematical skills as a masculine domain, or that such skills correspond to an innate ability of boys.

When the students were asked questions, most of them (boys and girls) pointed out that men had developed greater mathematical skills than women. This can be evidenced in the discourse of the participants, where PM corresponds to the female participants and PH to the male participants.

PM2: "because men are scientists and professors say that they are smarter because they probably believe that there are more men studying mathematics".

PM5: "because they take more attention in math".

PM6: "because they are smarter".

PM7: "because they are more skilled".

PM3: "they are faster".

PH1: "men apply themselves more".

PH2: "yes" (men have more skills than women in mathematics).

PH3: "yes" (men have more skills than women in mathematics).

PH4: "yes" (men have more skills than women in mathematics).

PM3: "they are faster".

As for the category "Usefulness of mathematics", it shows the students' conception of the usefulness of mathematics in their daily lives, three subcategories emerge from the discourse: 1) global use, 2) shopping and 3) measurement. It should be noted that, when analyzing the data, there is no tendency towards one subcategory or another when considering the gender variable in the discourse analysis.

Regarding the subcategory "global use", it is observed that students consider mathematics to be one of the most important subjects because it is present in everything, which is evident in the following units of analysis:

PM2: "it is very important because mathematics is everywhere".

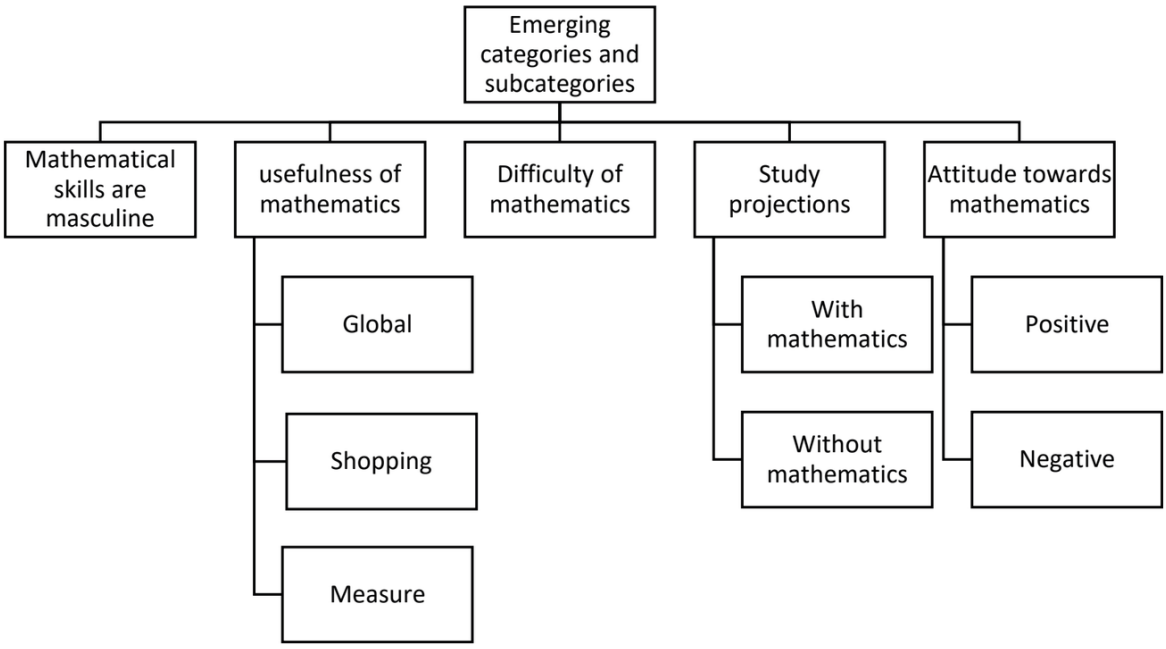

Figure x: synthesis of the emerging categories.

PM1: "is the one that matters the most".

PH1: "It's the one that matters most."

PH2: "if it is important".

PM4: "because it is used in everything".

PM5: "because it is used everywhere".

The subcategory "shopping" emerges since the participants indicated that mathematics was important because they used it in everyday situations such as shopping, knowing if they got their change right, etc., as evidenced in the following units of measurement:

PM9: "the importance of mathematics that we use everywhere to go to the supermarket mathematics, because now everything has to do with mathematics".

PH3: "example I have to deliver money and that what is left over has to be subtracted, deducted to deliver it".

PM4: "ehh when we go shopping we need mathematics to calculate how much we have to pay".

PM1: "if we get our change right".

The last subcategory "measurement" emerged from the answers given by the students, who pointed out that mathematics was useful, since through the use of mathematics they could develop in everyday life, either in a job or in different common situations.

PM3: "to build houses, buildings".

PH2: "for example, when one knows the measurements of the furniture to make furniture as well".

PM6: "to see the height".

PM4: "to see the plans".

Regarding the category "difficulty of mathematics", it arises from the students' conception of the difficulties they have in learning mathematics. It should be noted that although the participants consider mathematics to be difficult, they also consider it to be the most important subject and tend to choose careers related to this area. In addition, the women show a discourse related to effort, pointing out that although mathematics is difficult, with effort it can be achieved. The following is the discourse delivered by the students:

PM1: "they are also very difficult, it is the most difficult subject".

PM6: "difficult".

PM7: "I think it is difficult, but with enough effort you can learn".

PM4: "more or less".

PM8: "Well, mathematics is difficult, but by putting effort and studying, I can get good grades and learn more things, I used to have trouble with mathematics, I was doing very badly and now I am doing well".

In relation to the category "projections of study", the students make known their future professional preferences. Two subcategories emerged from this category: 1) with mathematics and 2) without mathematics, where women show a tendency to opt for careers related to mathematics. In the case of men, the majority opt for careers that are not related to mathematics, since they consider them to be very difficult. The following is the discourse delivered by the students:

PM8 "Yes" (I would like to pursue a career related to mathematics).

PM4: "yes, medicine".

PM5: "I would like medicine, because I like mathematics".

PM6: "veterinary".

PM7: "yes, scientific"

PM3: "I would like to be a business administrator".

PM5: "accounting

PM2: "Engineer".

PM8: "Engineering Mathematics".

PH2: "I would be a math teacher".

PH3: "I carabinero".

PH1: "speaker".

PH2: "no" (something related to mathematics would follow).

PH3: "no, because they are very difficult".

Finally, with respect to the category "Attitude towards mathematics", from which two subcategories are derived: 1) positive and 2) negative, the data show that the students express the attitudes they believe they should have in order to develop mathematical learning and skills.

In the subcategory "positive attitudes" most of the students recognize that in order to acquire mathematical skills they need to demonstrate that they: study, make an effort, concentrate, pay attention, among others. The following is the discourse delivered by the students:

PM7: "have discipline".

PM1: "to have a better study".

PM7: "I think it is difficult but with a lot of effort you can learn" PM8: "Well, mathematics is difficult but by putting a lot of effort and studying, I can get good grades and learn more things, before I had trouble with mathematics, I was doing very badly and now I am doing well".

PM7: "I don't think that it is the commitment that helps to get high grades, and if the commitment".

PM8: "concentration".

PM9: "a little attention".

PH3: "study".

PM4:" listen".

As for the subcategory "negative attitude" arises from a minority number of students who indicated that mathematics was not important, or that they did not like to participate in mathematics classes, which is evidenced below:

PM6: "I don't consider mathematics important".

PM3: "because sometimes they don't pass me because I don't like to pass in front".

PM3: (shakes head back and forth) "indicating that I do not participate" PM9: "I do not participate" PM9: "I do not participate".

CONCLUSIONS

From the results, a first conclusion that can be reached is that there are gender stereotypes in the discourse of the participants, both in the discourse of boys and girls, since in both cases it is considered that men have greater mathematical skills and that they have developed more capacities to develop in careers related to mathematics. This coincides with Brown and Josephs (2001), among other authors (Clair, 1996; Flores, 2007), since they emphasize that social stereotypes can be internalized at an early age, establishing the idea that men are "good" at mathematics and women are "bad". However, with the information collected, it can be concluded that, despite these stereotypes present in the discourse, girls are the ones who choose the greatest number of careers related to mathematics: medicine, science, engineering, among others. This contradicts what is expressed by authors such as Gamboa (2002), Jimeno (2012), who point out that women tend not to choose careers related to this area, which is attributed to the deficient opportunities given to them, to social stereotypes and to the low confidence they feel in their performance in this area.

A second conclusion is that the students are aware of the purposes of mathematics, and there are no gender stereotypes in this line, since they expressed indistinctly that they consider it one of the most important subjects, since they value it in terms of its usefulness in their daily lives.

A third conclusion is that the girls showed a more positive attitude towards mathematics, in spite of the difficulties they assumed they had in the discipline, they stated that by studying and making an effort they could succeed. This agrees with Petriz, Barona, López and Quiroz (2010), who point out that if students adopt a positive attitude towards mathematics, they could manage to put aside existing prejudices about this area of knowledge.

STUDY LIMITATIONS AND PROJECTIONS

The existing limitations in this study are framed within the number of participants and the context in which they work, since, due to time constraints, we only worked with two groups of participants and focused on the context of one type of establishment, public schools.

This study could be expanded by addressing the same topic, but listening to the voice of teachers and/or parents in order to contrast what students say.

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