A Study About Mathematician Vocations In Primary School

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Abstract

In this work we present the results of an investigation to diagnose the issue of mathematical vocations in Primary Education, with special emphasis on girls in the third stage of Primary Education. The study uses a mixed and parallel focus qualitative and quantitative approximation on a sample of 172 girls and 168 boys between 9 and 12 years old from eight educational centers in the municipalities of Vigo and Pontevedra, Spain. The instruments used for data collection were a 28-question questionnaire, interviews and discussion groups on the perception, knowledge and assessment of different aspects related to the question of mathematical vocations and the importance of mathematics in life. We found that individuals recognize the usefulness and importance of mathematics, but not its realization in professional activity or in daily life, associating mathematics mainly with calculation. Moreover, there is a clear difference in self-concept in boys and girls with respect to mathematics, girls believe that they have more difficulties to work with the subject and they think that they are more difficult. Finally, a gender bias was found in the responses consistent with traditionally feminized professions. Furthermore, it was found that girls are more aware of the application of mathematics than boys and the need to develop activities that give visibility to the scientific-mathematical role is confirmed.

Keywords: educational practice, gender bias, gender perspective, mathematical-perception mathematical-role

1. Introduction

At the present, the disconnection between society and research is evident, specifically in mathematics. As a science, mathematics is perceived as distant from everyday life and without applications. As a subject, there is a evident lack of taste, rejection or apathy from students. Among the possible causes, it is that many times in primary school mathematics are exposed as management techniques numerical data (Alonso Hidalgo et al., 2004). These and the following detected problems justify this research:

- Lack of taste, interest or even rejection of mathematics (Míguez Escorcia, 2004). The levels are significantly lower than the OECD average and the European Union as a whole (Trends in International Mathematics and Science Study, 2019).

- Social perception of mathematics in society as a science disconnected from everyday life, without applications.
- Disconnection between society and researchers (Fundación Española para la Ciencia y la Tecnología, 2013).
- Learning and Teaching methodologies of mathematics are often based on an empiricist model and traditional model, reducing themselves to an application of rules in a mechanical way, thus becoming a boring process, without significant learning and that produces rejection (Hidalgo Alonso et al., 2005; Libro Blanco de las Matemáticas, 2020).
- There is a significant gender bias among mathematics research professionals (Unidad de Mujer y Ciencia de la Secretaría de Estado de Universidades, Investigación, Desarrollo e Innovación, 2019).

All these factors affect the issue of STEM vocations and, in particular mathematics. To deal this situation, it is necessary to implement educational programs in early stages (Convención sobre la Eliminación de toda forma de Discriminación contra la mujer, 2019) that increase mathematics culture and education through non-formal actions and, at the same time, promote knowledge, interest and positive perception of mathematics. All this, guaranteeing gender equality and involving actors from different sectors of mathematics education and research. However, prior to the design of an educational action, it is necessary to carry out a diagnosis on the question of mathematical vocations.

The present work describes the research of the diagnosis carried out in educational centers of Vigo and Pontevedra (Spain) for the study of mathematical vocations in Primary Education. In this research a mixed approach was used to achieve a complete perspective of the entire phenomenon. On the basis from the gender perspective, different fundamental aspects of the educational methodology used were studied: scientific, transversal, technological and popularizing nature, presence of non-formal, attractive, motivating and innovative didactic elements. On the other hand, and in parallel, aspects such as the interest in mathematics, the appreciation of its social and economic utility and the perception of the profession of researcher in mathematics were analyzed. For this reason, the following objectives have been proposed:

1. Study the taste and interest in mathematics.
2. Evaluate knowledge about the importance of mathematics in life.
3. Examine the appreciation of mathematics as a useful science from a social and economic point of view.
4. Study the perception of the experience of the mathematical scientific role.
5. Analyze the role of educational practice in mathematics as a promoter of mathematical vocations.
6. Analyze gender bias in mathematician vocations.

It is important to note that the study is the first part of the educational intervention project “Te lo cuentan las matemáticas”. This project is funded by Fundación Española para la Ciencia y la Tecnología-Ministerio de Ciencia e Innovación and the Social Council of the University of Vigo. The main objective of this project is to encourage mathematical vocations among students in the final stage of Primary Education, paying special attention to the measures aimed at promoting gender equality.

2. Methodology

The methodology used in this research has a mixed and parallel approach design without mixing quantitative and qualitative data, but taking advantages of the characteristics and benefits of both methodologies to draw its conclusions. The quantitative and qualitative investigations were carried out by different researchers, in order to guarantee the independence of both processes, the verification and expansion of the information obtained.

2.1 Participants and instruments

This study involved a total of 410 students in the 5th and 6th grade of Primary Education from the cities of Vigo and Pontevedra. A non-probabilistic sample was used for convenience, with the inclusion criteria being the participation in the project "Te lo cuentan las matemáticas" and the acceptance of collaboration in the research study through informed consent and subsequent authorization from the educational center. Finally, a recruitment process was carried out after which the sample was made up of 172 girls and 168 boys, whose ages ranged from 9 to 12.

2.2 Instruments

In order to diagnose the group of participants, the modality of the quantitative study was non-experimental and descriptive. As a data collection instrument, a 28-question questionnaire was used on aspects related to mathematical vocations such as perception and knowledge, emphasizing the gender perspective (see Table 3). The qualitative research was interactive, based on a case study, using individual interviews and focus groups. Twelve interviews with 13 questions (see Table 1) and 3 discussion groups with 8 questions (see Table 1) were conducted, both guided from beginning to end.

Table 1: Individual interview

Items	Interview questions
1	Do you like math? Do you like mathematics? Why? Why not?
2	How easy / difficult does the subject seem to you?
3	Math classes, are they more or less fun than others? Why?
4	What do you normally do in math classes?
5	Do you think you use mathematics in your day to day? For what?
6	Adults, do you think we use math daily? When?
7	Could you name a profession in which mathematics is used? How are they used in those professions?
8	What do you think a mathematician is?
9	What do you think a math researcher does?
10	Do you know any famous mathematician or mathematician?
11	Do you know someone who works as a mathematician / math specialist?
12	Who do you think is better at math, men, women, or everyone equally?
13	Who do you think likes mathematics more, men, women, or everyone equally?

Source: (Own elaboration)

Table 2: Discussion group interview

Items	Discussion group questions
1	What is your favorite subject?
2	Do you find mathematics interesting?
3	Math classes, are they fun?
4	How do you think math classes could be made more fun?
5	How often, outside of class, do you use math? What do you use them for?

6	Do you think that mathematics has an important role in society?
7	Do you see a difference in how math is given to boys and girls?
8	If you think of a mathematician, what comes to mind?

Source: (Own elaboration)

Table 3: Questionnaire

Items	Questions
1	What is your favorite subject?
2	Do you like math? Yes/no
3	How good are you in mathematics? Bad / So-so/ Good / Very good.
4	Are you interested in mathematics? Not / A bit / Yes
5	I think the math subject is… Very difficult / Difficult / Easy / Very easy.
6	I think math is… Very boring / Boring / Fun / Very funny.
7	For everyday life, mathematics ... They are useless / They are of little use / They are somewhat useful / They are very useful.
8	Name 5 activities of daily life in which you think mathematics is essential.
9	Which of your mathematical knowledge do you think is most important for day to day? Mental calculation / Geometry / Graphs / Measurements of magnitudes / Statistics and probability.
10	In which of the following daily activities do you think you use mathematics? Cooking / Doing sports / Making a schedule / Shopping / In board games / Drawing / In video games / Watching TV / Looking at a map.
11	I consider that mathematics are… For men / For women / For everyone.
12	I think mathematics is better at ... Men / Women / It does not depend on being a man or a woman.
13	In mathematics classes ... We study theory / We do problems / We make games with which we learn mathematics / We carry out projects related to the subject / We investigate and learn about different mathematics and mathematics / We see examples of the use of mathematics in our day-to-day lives / We see its usefulness in other matters.
14	In math classes we use ... Book/ Notebook / Calculator / Computer / Measuring instruments (meters, clocks, rulers, squares, squares, compass, protractor, ...) / Recycled material / Polyhedrons and other geometric objects (cubes, spheres, ...) / Other materials (polycubes, toothpicks, Cuisenaire strips, ...).
15	Most of the math teachers I had were… Very boring / Boring / Fun / Very funny.
16	Math classes are ... More boring than the others / Just as boring as the others / Just as fun as the others / More fun than the others.
17	Math classes ... They make me not curious about the subject / They do not influence my curiosity about the subject / They make me curious about the subject.
18	Do you think math classes could be more fun if they were given differently? Yes/no
19	If yes, try to say how.
20	In which of the following jobs do you think mathematics is used? Architect / Teacher / Footballer / Astronaut / Electrician / Doctor / Accountant / Sailor / Airplane Pilot / Computer Scientist / Musician / Banker / Police / Plumber / Journalist / Nurse / to others.
21	What is a mathematician to you?
22	What jobs can you think of a math specialist can do?
23	Do you think there is a difference between the jobs that female mathematicians do and male mathematicians? Yes/no
24	If so, what do one and the other do?
25	Do you know, close to you, a specialist in mathematics? If so, who is he and what does he do?
26	What do you think a researcher in mathematics does?
27	Would you like to be a Mathematician? No, not a joke / It could be / Yes, for sure.
28	What would you like to work on when you grow up?

Source: (Own elaboration)

2.3 Procedure

Before starting, this research and its methodology have been submitted to the evaluation of the Research Ethics Commission of the Faculty of Education and Sports Sciencies (University of Vigo, Spain), to guarantee the protection of rights, safety and well-being of the participants.

In the questionnaire we used 14 items of closed format and single response, 5 of closed format and multiple response, and 9 of open format were included. The mean time taken by the subjects to cover the questionnaire was 15 minutes. It is important to note that previously, a pilot test was carried out with 10 individuals, from these results, changes in clarity and format emerged, and an estimate of the completion time was obtained, as well as an initial idea of the most likely pattern of responses. In relation to the individual interviews and focus groups, 13 and 8 items were structured respectively, and the time used by the interviewees did not exceed seven minutes. Data collection was carried out for two weeks in 8 educational centers.

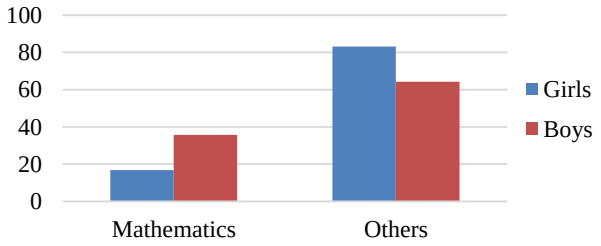
After data collection, quantitative and qualitative analysis was performed in parallel and by different researchers. Moreover, for proper data management, we have created units of analysis (see Section 3). Regarding the quantitative data, an analysis of the questionnaire was carried out using descriptive statistical methods. Once the correlations were obtained, we have done a factor analysis of the correlated items to study the structure of the data set and find new factors that explain and facilitate their study. In relation to qualitative data, an iterative and simultaneous analysis process based on data triangulation was used and structured as follow: information organization, data preparation for analysis, data review, discovery of analysis units, coding and description of categories and deduction of theories, models and hypotheses.

3. Results

3.1 Attitude, beliefs, and emotions towards: items 1, 2, 3, 4, 5 and 6

In the first item, it is determined that the subjects most cited in absolute values are Mathematics (89) and Physical Education (85), with a clear difference from the rest. However, if we look at the classification separately for boys and girls the results are different. Boys concentrate mostly on mathematics, but girls are more evenly distributed among the three predominant subjects. Furthermore, the change in the position of the mathematics subject is evident if we look at the responses of boys and girls (see Figure 1).

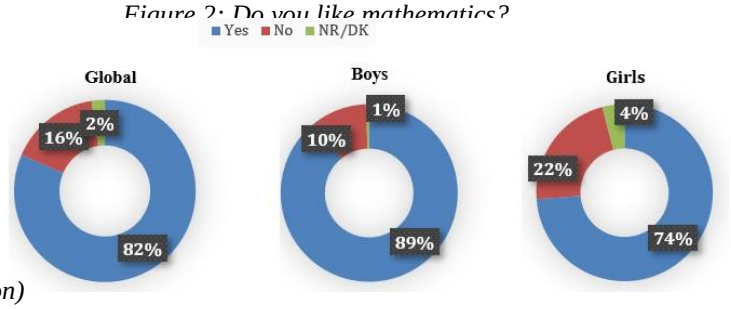
Figure 1: My favorite subject is…



Source: (Own elaboration)

Regarding item 2, it reflects a large group of boys and girls who like mathematics (see Figure 2). If we separate the results by gender, we observe that there is a notable difference: 73.8% of the girls have indicated that they like mathematics compared to 89.3% of the boys.

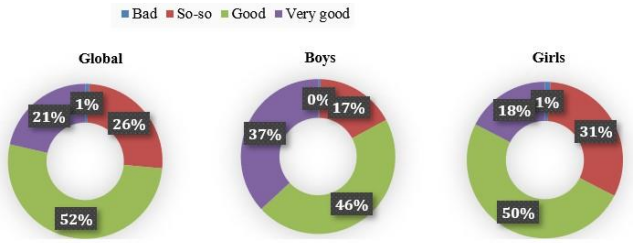
Figure 2: Do you like mathematics?



Source: (Own elaboration)

It has been obtained in item 3 that the difference becomes noticeable if we group the answers for those who "have no problems with mathematics" (answers "good" and "very well") and those who "have some" ("regular" and "bad"): in the second group we would have 32.6% of the girls and, on the other hand, 20.2% of the boys (see Figure 3).

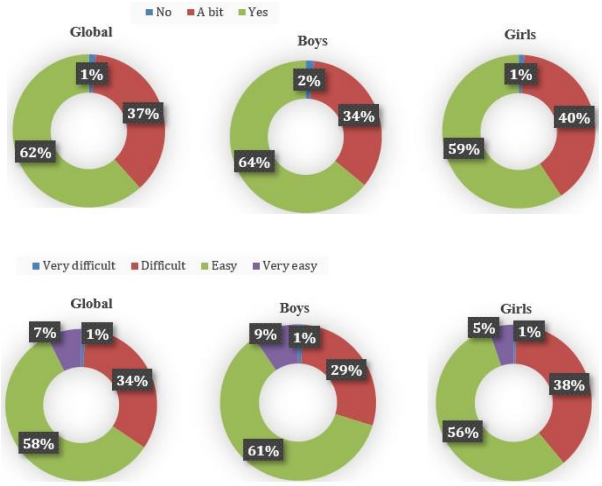
Figure 3: How good are you in mahememathics?



Source: (Own elaboration)

However, in item 4 there are no significant differences between boys and girls. For item 5, we see that girls perceive mathematics as more "difficult" and that among those who perceive it as "easier" boys account (see Figure 4).

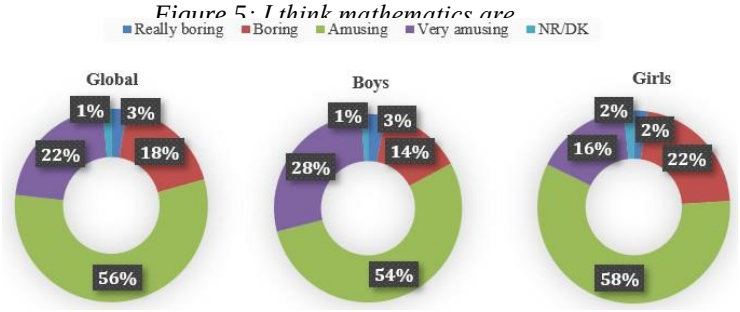
Figure 4: Interest and perception about mathematics



Source: (Own elaboration)

Finally, in item 6 the difference lies in the non-predominant answers: 28% of the boys marked "very funny" while only 16.3% of the girls chose that option; for "boring" the situation is reversed and here 22.1% of girls predominate compared to 14.3% of boys (see Figure5).

Figure 5: I think mathematics are



Source: (Own elaboration)

3.2 Importance of mathematics in life: items 7, 8, 9, 10 and 20.

The data in item 7 show that in general most individuals perceive the usefulness of mathematics. The values in boys and girls are practically the same, although there are more girls who think that they are very useful. In contrast, there are also more girls who think that they are "not very useful". Item 8 shows us the difference between the number of girls and boys who have mentioned: cooking (49 girls and 28 boys), drawing (13 girls and 2 boys), shopping (120 girls and 88 boys), on bills (12 girls and 6 boys). In general, girls have detected more applications than boys: 452 responses from girls versus 368 responses from boys.

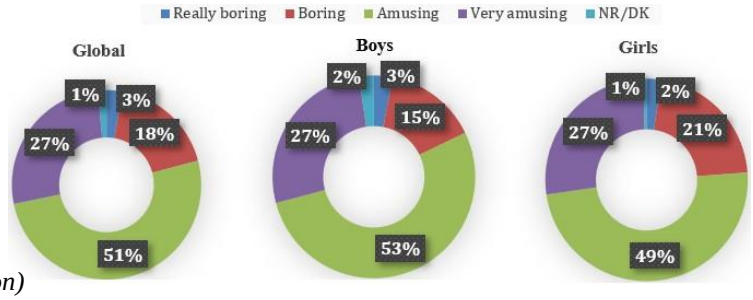
On the other hand, in item 9, 93.5% answered "mental calculation", the second most frequent being "statistics and probability" with 37.4%, a discipline closely linked to calculation. The other three options move around 25-26% very even. It should be noted that in this question, the answers do not show differences between genders. In the case of item 10, "making the purchase" is the most frequent response (302). There is a difference between boys and girls, similar to the answers to item 8 but in this case less pronounced. However, despite the fact that once again girls have marked more options than boys (763 girls and 707 boys), boys are the majority in video games, board games and watching television. For item 20, the most marked profession is teacher (320, only 20 did not mark it) followed by computer scientist (279), architect (264), banker (245) and accountant (240). There are differences in the responses of certain professions: a nurse has been marked by 94 girls and 65 boys, a doctor has been marked by 100 girls and 71 boys, a cashier has been added by another 10 girls and 5 boys, and a cook by 7 girls and 2 boys. Again in this case, girls mark more options (1,530 girls and 1,385 boys).

3.3 Methodology and teaching resources: items 13, 14, 15, 16, 17, 18 and 19.

The data in item 13 show that the most frequent response is to do problems, since 92.35% of the participants have marked this option. Around 40% have scored studying theory, playing games, seeing examples of mathematics in everyday life and seeing the usefulness in other subjects. Less than 20% respond that they carry out projects or research on mathematical figures. Furthermore, there are no significant differences between genders, only that girls once again have a slightly higher number of responses than boys. Regarding item 14, the most frequent answer is the "notebook" (317), followed by the book (248) and the measuring instruments (232). In item 15, if we group the "funny" and "very funny" answers, we would have 77.65% of the sample. Differences between boys and girls appear in non-predominant responses (see Figure 6).

On the other hand, in item 16 a 46.5% of the subjects think that math classes are just as fun as the others (without much difference between boys, 43.5%, and girls, 49.4%). Almost a third think math classes are more fun than others. However, in this answer we do find differences between boys and girls, since only 23.8% of girls think this compared to 36.9% of boys.

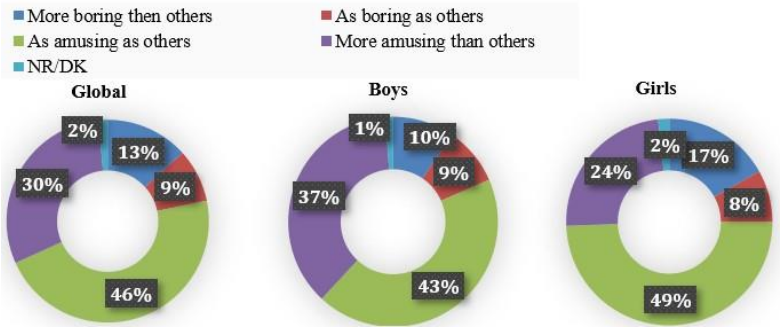
Figure 6: Most of the math teachers I had were…



Source: (Own elaboration)

In the "most boring" values the situation is reversed, where 16.9% of the girls are found and only 9.52% of the boys. The data obtained in item 17 indicate that 71.2% think that the classes increase their curiosity about mathematics, without substantial differences between boys and girls. Again the differences occur in the non-predominant responses. Item 18 shows that 60.3% of those surveyed think that classes could be more fun in another way, but in this case we found a considerable difference between boys and girls who think this (53.6% of boys versus 66.9% of girls). This result is consistent with item 16, in which girls found math classes slightly more boring than boys. Finally, item 19 shows that the most repeated suggestion and almost 10 times more named than the others is to play more games (122). Some ask for more use of the computer (16) and less homework or exercises and more group work (12) and finally more projects and research. It should be noted that 6 of the responses spoke of doing group activities that were done before and that "now it was not possible due to Covid".

Figure 7: Comparison of mathematics class with other subjects



Source:(Own elaboration)

3.4 Mathematical role: items 21, 22, 25 and 26.

In item 21, the most frequent answer to what is a mathematician? is: "a person who studies mathematics" (11.8% of the answers) followed by "is an intelligent person" (10%) ahead of "a person who is dedicated to mathematics" (8.5%). The number of responses defining a mathematician as "someone smart" (34) or even "someone important" (6). In item 22, we find a clear predominance of teacher (125) where again girls propose it more than boys. Far from the previous one at the same level are the answers architect (70), banker (69) or accountant (68).

On the other hand, in item 25, almost half said they did not know any specialist in mathematics. Item 26 is the only one in which any difference is perceived between boys and girls.

3.5 Mathematics and gender: items 11, 12, 23 and 24.

The data for item 11 show that 98.8% answered "for all" regardless of being a man or a woman. The situation is repeated in items 12 and 23. Regarding item 24, which completes the responses to item 23. The ways of dividing the work of men and women in mathematics do not follow an established criterion or any type of apparent pattern.

3.6 Mathematician vocations: items 27 and 28

In item 27, the predominant value is "can be" with 60.3%. However, there is no appreciable difference between boys and girls. In the case of those who say they want to be mathematicians, there are a similar number of boys (10) as there are girls (9). For item 28, it was obtained that the most frequent professions are teacher (36), policeman (24), veterinarian (15), soccer players (14), actor/actress (11), YouTuber (10). Moreover, if we group on the one hand professions that have traditionally been linked to women (teacher, fashion designer, cartoonist, artist, dancer, singer, make-up artist, actress and influencer, for example) and on the other professions that are traditionally considered male (police, architect, engineer, firefighter, footballer and YouTuber) we get that there are differences between girls and boys, corresponding to the traditionally considerations. Moreover, significant correlations were found between items 1,2,3,4,5,6,15 and 16, as shown in Figure 8.

Figure 8: Significant correlations

Source:(Own elaboration)

Regarding the qualitative results, after the process of coding the interviews and the discussion groups, a total of seven categories emerged: Intrinsic Motivation by Matter (MI), Knowledge about the importance of mathematics in life (C-Mat), Perception of mathematics as a useful science in life (P-Mat), Perception of the mathematical scientific role (PRM), Educational methodology and teaching resources (MET-DID), Mathematician Vocations (VOC-Mat), Mathematics and Gender (Mat-Gen).

4. Discussion and conclusions

4.1 Attitude, beliefs, and emotions

The subject of mathematics is the most voted in absolute values and, although it maintains the first place for boys, it goes to third place among girls. 81.5% of participants affirm that they

like mathematics, a significantly higher percentage than in other studies of more than a decade ago in the same ages, where 70.25% are obtained in the 3rd cycle of Primary (Hidalgo Alonso et al., 2005) and 72% in 5th grade of Primary (Hidalgo Alonso et al., 2004). Regarding the self-evaluation of knowledge, 73.5% think that mathematics is good or very good, this reflects that, a priori, mathematical self-concept is not as deteriorated as in higher education levels. We have obtained a value slightly higher than the value of "I have no problems understanding mathematics" in 5th grade primary students, which is 69.66% in (Hidalgo Alonso et al., 2004). Regarding the difficulty of the subject, more than half (65.59%) consider them easy or very easy. However, in this case the value is lower than that obtained in (Hidalgo Alonso et al., 2004) for students in 5th grade of Primary, where it is reflected that 76.89% consider it easy. We conclude that girls show less taste for mathematics.

Furthermore, it was found that there are significant differences between the perception of efficacy in the study of mathematics: girls score more than "they are good enough" and boys score that they do "very well", there is a clear difference in self-concept in boys and girls. How they perceive their ability to handle the subject is closely linked to their perception of difficulty, and in this case the data from item 5 are consistent with item 3: more girls than boys find mathematics difficult and more boys than girls find it very easy. We found that there is a positive correlation of the answer in item with other items. Correlations have been considered from values close to 0.3 with a p-value lower than 0.01. The p-value has been calculated using the Z distribution ($n>30$). The correlation with items 3, 4, 5 and 16 is stronger in the case of boys, which indicates that self-concept, interest, difficulty, and fun have a greater influence on their taste for mathematics. There are positive correlations between Attitudes, beliefs and emotions and Methodology and educational resources blocks, being in almost all cases the correlations stronger in the case of girls except between items 3 and 4.

4.2 Importance of mathematics in life (perception and knowledge)

In general, 96.5% of the subjects believe that mathematics is useful or very useful. However, this variable shows very low correlations with respect to the questions in the first block on perception of mathematics. Also, regarding "where is mathematics useful?" the predominant responses are actions that involve direct calculations: shopping, measuring, cooking, to use money. The hypothesis arises that there is a perception in the participants that mathematics is basically calculation. Hypothesis reinforced and confirmed by the following question, in which almost everyone answered that the most useful mathematical knowledge in their day-to-day life is mental calculation, far from the second most named, which is statistics and probability, a discipline also linked to calculation. As for professions that use mathematics, the most repeated answer is "teacher". But professions like accountant have high frequencies, something that reinforces the idea that there is an association between mathematics and calculus. We deduce that there is an established relationship between mathematics and calculus, but they do not correctly recognize the use of mathematics in professional activity. Regarding the responses of boys and girls, it seems that girls perceive the applicability of mathematics more than boys, since in open-ended and multiple-response questions the number of responses of girls considerably exceeds those of boys (items 8, 10 and 20). We conclude that there is a gender bias in the responses in accordance with the social conception of the professions.

Regarding the C-MAT and P-MAT categories, the subjects consider that mathematics is useful in everyday life, that it has an important role in society and that they will use it in the future. It

should be noted that, there is little knowledge about the perception of mathematics as a useful science in a broad sense, because the responses only consider the usefulness of mathematics in the field of calculation "for shopping" and "in the supermarket", economic field P-Mat-Eco.

4.3 Methodology and teaching resources

From the data analysis, it was obtained that the methodology used is the traditional one, in item 14 it is observed that the most used resources are: book, notebook and classic measuring instruments. Only 37.7% use technological resources. We can extract from this part that to make the classes more fun, it is not required to reduce the exercises or the material, but rather that what is required is to change the teaching-learning methodology through the increase of manipulative and playful activities. On the other hand, regarding responses by gender, there are small differences such as: girls tend to perceive classes as more boring or a little boring while boys perceive them as more fun. In addition, the girls state that the classes do not influence their curiosity, but in contrast, the boys indicate that the classes diminish their curiosity.

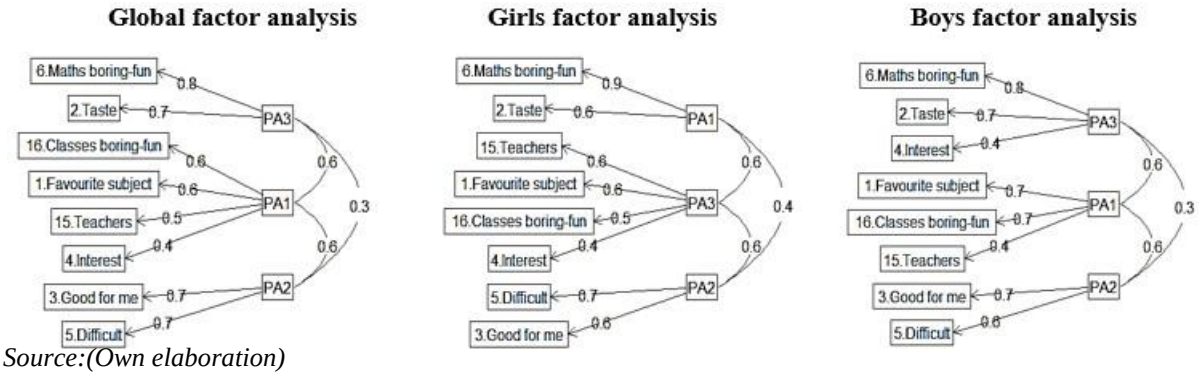
Regarding the qualitative analysis, the results of the MI category show that the subjects have a taste for mathematics in general and that the percentage is higher in boys than girls. However, the relationship with the MET-DID category shows that teachers prioritize a traditional methodology, and it is not enough to develop students' intrinsic motivation, since there is a high number of children who miss fun and manipulative activities.

In order to deepen in the relation between MI and MET-DID categories and leaning on the cuantitative results, we have made a factorial analysis of the correlated items related with both categories: items 1, 2, 3, 4, 5, 6, 15 and 16. We obtain values of Cronbach's alpha equal to 0.78, 0.80 (girls) and 0.75 (boys) that guarantee the reliabity of the test items.

An Exploratory Factor Analysis was carried out using three different methods to check the degree of association between the items of the correlation matrix. First, Bartlett's test of sphericity and correlation matrix determinant test if the items are related. We get $\chi^2 = 774.0705$, df = 28, p-value=5.942916e-145 < 0,001 and det=0.09954, which means that factor analysis may be useful due to our items are related. Then, using Kaiser-Meyer-Olkin Measure of Sampling Adequacy, we obtained KMO value of 0.82, which means that Factor analysis is adequate and useful. Since our sample is not normally distributed, we use Principal Axis Method for factor extraction. Parallel analysis suggests three factors in global, girls and boys data. Once factors are obtained, we observe a relevant correlation between them and therefore a PROMAX rotation is used. The proportion of the variance explained by the model is 0.50 in Global data, 0.52 in Girls data and 0.49 in Boys data. Moreover, the root mean square of the residuals (RMSR) and the mean complexity in each data are 0.01 and 1.3, 0.02 and 1.4, 0.01 and 1.3, respectively.

In Girls and Global data, our items are grouped into the same factors: Factor I (items 2, 6): Mathematic taste, Factor II (1, 4, 15, 16): Methodology and subject relevance, Factor III (3, 5): Self-concept and difficulty. However, in Boys data, item 4 moves from Factor II to Factor I. Figure 9 describes the factorial charges of the items into factors. This information shows that interest in mathematics for girls depends on methodology and for boys is binded to taste.

Figure 9: Factorial charges between items 1, 2, 3, 4, 5, 6, 15 and 16



Source:(Own elaboration)

4.4 Mathematical role, mathematics and gender, mathematician vocations

The data show a lack of knowledge of the profession of mathematician, specialist in mathematics or researcher in mathematics, linking it to teaching or to professions in which mathematics is used. They conceive the concept of researcher as something different from teaching, but without a clear idea. In some way, this is explained by the lack of mathematical references. On the other hand, most of the participants consider that mathematics is for everyone -men and women-. However, in the results and analysis of the other blocks of this study items, a clear gender difference is observed. We conclude that there is neither perception nor conscious reflection on the issue of gender bias. Besides that, there is no perceived rejection towards the profession of mathematician, nor towards working in any profession that involves the use of mathematics. As we have analyzed, there is a lot of variability and a great gender bias in the professions: girls -traditionally female- and boys -traditionally masculine-.

Regarding the PRM and VOC-Mat categories, children generally do not recognize what a mathematician is and what he does. We have found within the Mat-Gen category that there are certain traits on the valuations present in society regarding male roles and work, they have prioritized professions such as accountant, banker, architect, or carpenter. Only two girls mentioned that they know a woman who works as a mathematician, compared to seven responses where they knew a man or did not know anyone. In contrast, we see that the questions to whom "do you think is better at mathematics, men, women or all equally?" and "who do you think likes math the most, men, women, or everyone equally?" all the interviewees have responded that "all equally".

We think that it is necessary to develop activities that give visibility to the scientific-mathematical role, showing how all areas of mathematics contribute to the development of a society. Likewise, we believe that the implementation of active, innovative, transversal, and manipulative methodologies is necessary to strengthen taste, interest, and self-concept in relation to the subject. In addition, we consider that it is important that children have examples and references of female mathematicians, in order to eradicate stereotypes from an early age.

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