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The possible relationships between the foregrounds of Obmep medalists and their mathematics learning

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Abstract: This article presents reflections from a study that addressed the foregrounds of medal-winning students at the Brazilian Mathematics Olympiad of Public Schools (Obmep) in the Piauí municipality of Cocal dos Alves. The research aimed to identify the reasons that motivated students to want to learn Mathematics. It was exploratory and qualitative, with an emphasis on analyzing the case in that municipality. Data production took place through semi-structured interviews. To interpret them, we used thematic analysis. The reflections suggested that students would be motivated to learn mathematics because of what they want for the future and the changes in their lives that could be achieved. They were hopeful and revealed that they were aware that their dreams could be achieved. Furthermore, their positive perceptions of their aspirations were influenced by contact with people who had been in similar situations, as well as support from their teachers.

Keywords: Mathematics. Foreground. Obmep.

Las posibles relaciones entre los aprendizajes de los medallistas de la Obmep y su aprendizaje de matemáticas

Resumen: Este artículo presenta reflexiones de un estudio que abordó los antecedentes de los estudiantes ganadores de medallas en la Olimpiada de Matemática de las Escuelas Públicas Brasileñas (Obmep) en el municipio de Cocal dos Alves, en Piauí. La investigación tuvo como objetivo identificar las razones que motivaron a los estudiantes a querer aprender matemáticas. Fue exploratorio y cualitativo con énfasis en analizar el caso en ese municipio. La producción de datos se realizó mediante entrevistas semiestructuradas. Para interpretarlos utilizamos el análisis temático. Las reflexiones sugirieron que los estudiantes se sentirían motivados a aprender matemáticas por lo que quieren para el futuro y los cambios que se podrían lograr en sus vidas. Se mostraron esperanzados y revelaron ser conscientes de que sus sueños podían ser alcanzados. Además, sus percepciones positivas sobre sus aspiraciones estuvieron influenciadas por el contacto con personas que habían estado en situaciones similares, así como por el apoyo de sus profesores.

Palabras clave: Matemáticas. *Foreground*. Obmep.

As possíveis relações entre os *foregrounds* de medalhistas da Obmep e suas aprendizagens de matemática

Resumo: Este artigo apresenta reflexões de um estudo que abordou os *foregrounds* de estudantes medalhistas da Olimpíada Brasileira de Matemática das Escolas Públicas (Obmep)

do município piauiense Cocal dos Alves. A pesquisa teve como objetivo identificar os motivos que impulsionaram os(as) estudantes a quererem aprender matemática. Ela foi do tipo exploratória e qualitativa com ênfase na análise do caso no referido município. A produção dos dados aconteceu por meio de entrevistas semiestruturadas. Para a interpretação deles, recorreu-se à análise temática. As reflexões sugeriram que os(as) alunos(as) estariam motivados(as) em aprender matemática por causa do que almejam para o futuro e das mudanças em suas vidas que poderiam ser alcançadas. Eles(as) se mostraram esperançosos(as) e revelaram ter consciência de que seus sonhos poderiam ser alcançados. Além disso, as percepções positivas deles(as) sobre suas aspirações foram influenciadas pelo contato com pessoas que estiveram em situações semelhantes, bem como pelo apoio de seus professores.

Palavras-chave: Matemática. *Foreground*. Obmep.

1 Introduction

Not learning mathematics can cause difficulties for students and may prevent them from moving up socially, leaving them on the margins of society (Skovsmose, 2005). The difficulties of learning mathematics could strengthen or ruin students' dreams or projects.

The foregrounds include dreams, those that can be realized, and those that may initially be considered difficult or impossible to achieve. The term dream in the context of discussions about foregrounds "does not mean the dream projections that we manifest when we are sleeping, although these can be representations of what we dream while we are awake" (Soares, 2022, p. 151). The dream to which the theorists of critical mathematics education refer is consciously imagined.

These difficulties that arise during mathematics learning are often attributed to the fact that students do not have the aptitude for the area and are a consequence of mathematics teaching approaches that do not promote reasons for learning. The absence of reasons for involvement in these processes can affect students' futures (Biotto Filho, 2015).

When reflecting on students' reasons for learning mathematics, Skovsmose (2014) proposes the concept of foreground as the elaboration of life perspectives that a person constructs for their future, considering the opportunities that the social, political, and cultural situation provides them. Students' foregrounds seem to influence their motivations for learning mathematics (Skovsmose, 2021). Thus, for example, the discrimination one faces for living in socially vulnerable environments can motivate or demotivate mathematics learning (Skovsmose et al., 2012). Thus, when students suffer discrimination, they end up reinforcing their awareness of their stigmatized positions, and this situation is a social factor that provokes the dream of escaping as a reaction. Education is a possibility to escape that situation; learning mathematics, in particular, makes sense and represents an investment in the future.

Statistics suggest that students' decision to pursue a degree depends on gender, ethnicity, and economic resources, which can socially condition young people's foregrounds (Skovsmose, 2021). The idea of foreground can help teachers identify why students do not want to be involved in mathematics teaching activities. From this perspective, possible explanations would not be restricted to classroom processes but would consider the devastating socio-historical conditions of students' foregrounds.

This article presents aspects of completed doctoral research (Ibiapina, 2021), emphasizing the existing relationships between the foregrounds of medal-winning students from Cocal dos Alves, Piauí (PI), and their mathematics learning. To this end, a question prompts us to reflect: What relationships exist between the foregrounds of medal-winning

students and their involvement with mathematics? In this way, we investigated the foregrounds of these medal-winning students to understand the reasons that could lead them to learn mathematics.

Thus, the research was developed in the municipality of Cocal dos Alves because, despite adverse social conditions, the city holds a high number of students winning prizes (227 medals) in the Brazilian Mathematics Olympiad of Public School (Olimpíada Brasileira de Matemática das Escolas Públicas - Obmep). This municipality is in the northern region of Piauí, with a population of around 6,386 inhabitants (Instituto Brasileiro de Geografia e Estatística [IBGE], 2022), 278 km away from the capital Teresina and with a Human Development Index (HDI) classified among one of the lowest in Brazil.

2 Critical mathematics education: the concept of foreground

Critical mathematics education (CME) is not a branch of mathematics education, a methodology to be used in the classroom, or a specific curriculum; rather, it comprises a response to a critical position in mathematics education. Skovsmose (2007) has a political objective and desire to see mathematics education as a democratic and liberating practice:

> I am interested in the possible role of mathematics education as a gatekeeper responsible for bringing people in and how it stratifies people. I am concerned about any discourse that might attempt to eliminate the sociopolitical aspects of mathematics education and define politically determined learning obstacles as personal failures. I am concerned about how racism, sexism, and elitism could operate in mathematics education. I am concerned about the relationship between mathematics education and democracy (p. 176).

When discussing aspects of CME, Skovsmose (2007) focuses on the contradictions between the relationships between mathematics education and critical education. The author argues that, in order to integrate these two areas, mathematics education must play a critical role in sociopolitical processes by considering which alternatives are possible and that finding them can make a difference. The critical dimension of mathematics education is not limited to some social function, for example, when guidelines or guiding principles are included in the national curriculum.

For Skovsmose (2007), CME must consider higher and basic education issues. It is also necessary to consider mathematics education from the perspective of globalization, covering all the characteristics that globalization can encompass and what mathematics education could mean for those potentially excluded.

CME must be aware of students' situations, considering their past and possibilities for their future. In this sense, conceptualizing the foreground is essential. According to Alrø et al. (2009), foreground is related to a person's interpretation of their learning possibilities and life opportunities regarding what appears to be acceptable and available in various contexts. The foreground represents a realistic consideration of what each person sees as their possibilities in the future, considering the context that shows what is possible to achieve. It involves people's aspirations and frustrations and comprises their experiences and interpretations of possibilities, tendencies, propensities, obstructions, and barriers, constituting a mixture of personal and social factors.

Skovsmose (2005) explains that this concept can facilitate the discussion about the "politics of learning obstacles". Skovsmose (2014) argues that learning obstacles can be found in children's real situations concerning the opportunities that society makes available to them.

The actual distribution of wealth and poverty involves a distribution of learning possibilities and obstacles. Obstacles to students' future life possibilities are particularly devastating learning obstacles (Skovsmose, 2022), which can take the form of a ruined foreground. The term ruined does not mean the absence of foreground but the lack of attractive and realistic opportunities. A ruined foreground can be associated with the idea of dreams in cages, as it can be such a brutal form of exclusion that it even imprisons dreams and limits the future visions of the excluded (Skovsmose, 2014).

On the other hand, the concept of boundary position discussed in Skovsmose et al. (2012) refers to a situation in which a person can see their living conditions regarding other possibilities. This aspect can affect the foregrounds because students at the edge can visualize what would be possible for them and their education if they crossed that border and came into contact with other ways of life. For the person who lives on the margins of the dominant culture, the difference between their reality and others is well defined.

Reflections on the foreground can help students participate in educational practices and construct their intentions. Intentions play a crucial role in human experiences and actions. They include a direction toward the future formed by the person based on their priorities, assumptions, expectations, and aspirations.

Skovsmose (2014) emphasizes that intentions influence actions characterized by their orientation toward possibilities. Every action has an objective and, consequently, intentions. Actions may involve a set of aspirations, hopes, and expectations. To look for the causes of an action, we must analyze the foreground of the person who acts since the action makes clear the intentionality of whoever performs it, revealing their foreground. Each person's foreground is a powerful source of reasons and intentions that enable them to engage or not in learning processes (Skovsmose et al., 2012).

The actions, intentions, and foregrounds are intertwined. In this way, a person's actions are directed to some foreground characteristics. Acting means following an objective to achieve something, trying to realize a possibility so that a particular thing can be achieved.

For an activity to be recognized as an action, intentionality must be behind it. Furthermore, there must be choices; one cannot act consciously in a predetermined situation. The action presupposes both the person's involvement and a predisposition. For example, the meaning of the activity developed in the classroom is a student's construction and depends on how they see their possibilities in life; this construction depends on their foregrounds and intentions.

Skovsmose (2022) conceives learning as an action. So people decide to get involved in it. Learning as action can only happen based on a person's willingness to find reasons to participate in it, and these are related to their backgrounds and foregrounds. The background is the person's previous experience, given their involvement with social, economic, political, and cultural contexts.

Foregrounds and backgrounds are related (Skovsmose, 2022). In this way, "motives for action can be formed from the person's background, but also through what I refer to as the person's foreground" (Skovsmose, 2022, p. 372). In addition, Biotto Filho (2015) states that past experiences can influence what people want for their future, i.e., it is necessary to take into account people's background to understand some aspects of their foreground. The background does not predetermine a foreground, but a ruined foreground may result from the background.

3 Methodological trajectory

The research was developed with 18 students from Cocal dos Alves, PI, medalists of the 2019 edition of Obmep, 14 of whom were male biological sex and four female biological sex. When the interviews were carried out, the participants were mostly in the eighth or ninth grade of elementary school or some grade in high school. Three teachers who taught mathematics in regular classes and preparation for the Obmep of the interviewed students also participated.

The students' ages ranged from 13 to 19, with eight participants showing a distortion between age and school grade. The age-grade distortion is an educational indicator that makes it possible to monitor the percentage –according to each school grade– of students above the expected age for the grade they attend.

Contact with them happened through one of their mathematics teachers. During the first communication between the leading researcher and each student, we explained the research objectives and asked whether they wanted to participate. We also defined the best day and time for the interview.

Ethical procedures were guaranteed to protect the participants. They had access to a free and informed consent form that explained the procedures of the research method and the possible implications of participating.

The research was exploratory, as it sought to obtain qualitative and quantitative descriptions of the object of study (Gonsalves, 2001). Regarding the nature of the data, the investigation can be classified as qualitative, more specifically as a case study approach (Yin, 2001), which refers to medalist students at Obmep in Cocal dos Alves.

The instrument used to produce the data was a semi-structured interview, as it allowed for direct, immediate, and detailed subjective information, as well as interaction between the researcher and the interviewees. The questions were previously defined and developed in a context similar to that of an informal conversation, with the dialogue adjusted and redirected whenever necessary to maintain the purpose of the script.

As the country was experiencing a pandemic of infectious diseases caused by the Coronavirus (SARS-CoV-2), the interviews took place remotely through WhatsApp, the most accessible app for students. Interviews with teachers were carried out via Google Meet. Video calls with students and teachers were recorded, and the captured material was used only to assist the researcher in collecting information.

We opted for content analysis of the interviews, which allowed us to interpret the messages and understand their meanings. We used the construction of thematic categories, which enabled us to choose phrases as coding units and identify the frequencies of themes related to the participants' speeches (Bardin, 2011). The analysis of the material was organized into the following five phases: pre-analysis, exploration of the material, treatment of results, inference, and interpretation.

In the first phase, a floating reading was carried out, and at the end of it, we found it necessary to create more objectives to take advantage of all the material. The technique used to systematize and select the information consisted of grouping the answers from each part of the interviews. Next, we raised some more direct questions that the students' answers could elucidate, which was necessary because the questions were not direct, making extracting some information difficult.

When coding the material (Bardin, 2011), the interviewees' statements were related to units of meaning for interpretation. Although it was qualitative research, the answers were

quantified, but without an approach with statistical tests, only the frequency of appearance of meaning or expression items was observed.

Categorization made it possible to classify the elements according to what each shared with the others — this moment involved two stages, which Bardin (2011) called inventory. It consists of isolating the elements and classifying them — which is its distribution– seeking to organize the messages. This movement occurred based on what was identified in each interview question, using semantic criteria, mainly thematic categories.

Students were identified with a code, the first two symbols of which indicate the grade of schooling. Thus, code A7 refers to a seventh-grade participant. Symbols 1, 2, and 3 indicate the high school grades. The codes composed of (N + number) differentiate each participant from the same class. For example, A8N3 and A8N4 are students in the same eighth-grade class. Teachers were protected with fictitious names.

4 Results and discussions

This section is divided into six parts. For each, an aspect of the results is analyzed. Let us start with the students' backgrounds.

4.1 Students' backgrounds

First, we present some aspects of students' backgrounds, as this information provides trends for configuring foregrounds (Biotto Filho, 2015). Regarding their perceptions about their territorial spaces, nine live in the urban area, and seven in the rural area of Cocal dos Alves. Another two participants live in the urban center of a neighboring municipality and study in Cocal dos Alves precisely due to the schools' focus on Obmep.

When describing the region where they live, 11 students mentioned some of their municipality's characteristics; three described where their houses were located, four mentioned the municipality's population, and two used more than one adjective to particularize the city. The adjectives used to characterize the municipality were: "small," "calm," "peaceful," "warm," and "unsophisticated." The most mentioned were "small" and "calm," with five mentions each. Two students reported that the municipality was "naive," and one that it was "hot." Four participants used the adversative conjunctions "but" and "despite" to highlight advances in education and the Olympiad to counter the perception that the city was small or naive.

Some students have economic limitations in common. They indicated that they live in a small city far from large urban centers, usually associated with "higher" social and economic development than they experienced. This idea that their contexts are linked to a "delay" can block their hopes and aspirations, leading to the deterioration of their prospects. The notion of foreground is linked to a person's understanding of opportunities available in contexts (Alrø et al., 2009). Thus, the economic conditions, cultural belongings, and dominant discourses structure people's foregrounds. Therefore, if a person's perception is centered on economic limitations, these could restrict their foregrounds.

When the students mentioned the quality of education, they seemed to have hopes about their futures. They believed that, through education, they could have a better chance of accomplishing their dreams. When students face discrimination, this tends to reinforce their awareness of their stigmatized positions, which triggers the dream of escaping as a reaction (Skovsmose et al., 2012). Although they see education as a source of hope, it is clear that their prospects are at risk since the social context in which they live can limit them.

Regarding family life, most students (14) live with their parents, while four participants mentioned that they live with their mothers. When asked about their perceptions of their families, the participants offered different answers. However, they generally expressed a positive view of interpersonal relationships with their family members. Only A3N1 and A3N2 highlighted their families' challenging financial conditions but emphasized that this was not a problem, as they lived comfortably.

Two participants reported the education level of their family members. For example, A8N4 made remarks on his/her grandparents' level of education, explaining that his/her grandmother was illiterate, which the student attributes to the fact that she became a mother at a very early age. The student also said that his/her grandfather was literate but had little education and concluded by highlighting that his/her mother had the family's highest educational level.

Concerning parents' professions, in general terms, no profession predominated among students' fathers and mothers. Most mothers had jobs outside the home. Only one of the fathers was involved in an occupation related to school education, while six mothers worked in the educational field.

Regarding teachers' perceptions of their students, teacher João stated they were "unsophisticated, hard-working, and keen on learning." He also said that "the students who go through Obmep are not even better than the others, but they are those students who are not afraid of mathematics, they like it," and that it is only "year after year that they become good at mathematics, that they develop".

Teacher Pedro stated that the students "are more restrained, [...] they have a more rural, countryside realities". He also said that "he realizes that students keep habits that are still somehow linked to that culture of seeing the teacher as a figure of authority." According to the teacher, this "both hinders and helps. It helps because it is easy for the student to get involved in any project; they disagree less, but it gets in the way because they participate less, too."

Teacher Marcos, in turn, commented on their "low" socioeconomic profile. He also said he could not say "the technical term" but that his "students are poor and that one or another student's father has better conditions". The teacher also said his "students are different because they want to succeed in life, to go to a good college". He thought that although his students "are very poor, [they] aspire to be someone in life through their studies."

The teachers believed that no aspect of their students' lives made it easier for them to become medalists. For example, teacher João believed that if it were somewhere else, "it would even be harmful, as the student comes from the countryside, takes an hour by bus, and has no Internet." Teacher Pedro stated that "the geographical conditions of the city work in favor of the students, as worldly opportunities are much smaller among boys." To him, students who "live in the countryside don't have much to do".

Teachers Marcos and João also highlighted that the example of students who have been in the same situation and achieved success incentivizes others to want to participate in the Olympiad. Teacher João stated: "What makes them want to go after the Olympiad is the vision they already have about those who are there; it's like that desire to participate, whether they want to or not, in quotation marks, a little bit of envy of it all." Teacher Marcos added that "when they enter school and see these examples, [...] they see that it is possible, then yes, they will be inspired."

The teachers emphasized that the students had poor financial conditions, lived in remote communities, and were not predetermined to be somebody. Indeed, teacher Marcos stated that

with "ordinary students[1], [teachers] can help them to aim, with a chance of success, at a better life thanks to study."

The teachers' explanations indicate that some students had their foregrounds at risk. The teachers' statements align with students' justifications, as they refer to the context of economic and social limitations, which can make decision-making in mathematics learning difficult. Furthermore, according to their teachers, they present elements that can be difficult, such as being more observant and still. Skovsmose (2014) says it may be an obstacle to students' learning and, thus, ruin their foregrounds.

However, teachers try to help their students build their foregrounds to see what they can achieve through education, which can lead them to become involved in mathematics learning processes. Thus, teachers can succeed in their intentions to change and influence students' motivations for learning mathematics because the foregrounds are dynamic (Skovsmose et al., 2012).

4.2 Difficulties during mathematics classes

Nine participants stated that they did not experience difficulties in mathematics classes. Indeed, A8N4 stated that he/she did not experience difficulties, as his/her teachers explained very well, and that because he/she had studied in Obmep programs, he/she would have better knowledge.

Four students who experienced difficulties stated they were related to the subjects, not signaling the contents. Two said that they experience difficulties at the beginning of the topic when it is new. Moreover, two more indicated that it depended on the subject.

Two students' explanations mentioned their difficulties in probability and combinatorics, as well as in interpreting some problems and themes. Furthermore, one student revealed that he/she had difficulty with some concepts, as he/she forgot them; another stated that it was about solving some questions. Another said that, generally, he/she did not experience difficulties but did so in online classes.

When asked how they overcame these challenges, the students commented that they made an effort by studying, researching, or watching some class videos on the subjects. Moreover, they asked the teachers, and six students said that they had turned to the teachers so that they could explain it again.

We can infer that students' difficulties are specific since some stated that they experience difficulties — at the beginning of the subject with new issues — in interpreting and solving some problems. They also say they even forget some concepts. However, if these difficulties are not addressed, they can become obstacles to students' learning and, as a result, ruin their foregrounds (Skovsmose, 2014).

As for their opinion on why there are people who experience difficulties during their mathematics classes, seven students cited their predisposition to the subject. For example, A8N3 said that "some people have a slower mind to understand the subject." In addition, A2N1 stated that "some people cannot understand very well." A1N1 stated that the person needs to have "skills with numbers." Therefore, we can see that these students blame themselves for their difficulties.

Five participants said that classmates' lack of commitment was responsible for the gaps in learning. A8N4 stated that "because the person does not have much commitment, they are

[1] Students who do not have some aspect or characteristic that allows them a "differentiated" performance.

not very interested in mathematics." At the same time, four students gave answers that could be understood as self-blocking toward the subject. They attribute this fact to the stereotype that mathematics is complex, so those students cannot learn it.

A8N4 and A9N1 blame teachers for the difficulties. For example, A8N4 said that "the way the teacher teaches mathematics, [...] perhaps it even happens that the student feels terrified of mathematics because of the teacher." In turn, student A9N1 argued that they also experience difficulties "because they don't like the teacher."

Several factors contribute to students' difficulties in mathematics classes. Students' difficulties in mathematics classes may be associated with their perspectives, which promote different reasons for them to become involved or not in mathematics learning (Skovsmose, 2005). These difficulties may become strong or ruin their foregrounds. However, Skovsmose (2021) states that it is necessary to consider the extent to which the social conditioning of their foregrounds puts them in situations that prevent them from establishing reasons to learn mathematics.

4.3 Affinities with school subjects

When asked which five subjects they would choose from the ones they are studying, they picked 13. All participants chose Mathematics. Physics, History, and Portuguese were chosen by 11 students. Geography was selected by eight students, Biology and Chemistry were highlighted by seven each, while Science was chosen by six participants, Physical Education by four, English by three, Spanish by two, and Philosophy and Sociology by one student each.

Only high school students chose physics –only one participant did not select it– while six elementary school students chose Science, which suggests that the participants have a rapport with the natural and exact sciences subjects. Furthermore, the high number of students who chose Portuguese and History, in addition to Geography, shows a diversity of choices.

Regarding the reasons for choosing these subjects, eight students said they liked the subjects. Four stated that they have a rapport with the subject. Three emphasized that they are interesting. And three students said they were important.

When asked to order the subjects, mathematics had the highest frequency (14 students) for first place. The subjects most ranked in second place were Physics (7) and Science (4). In third place, the highest frequencies were associated with the subjects of History (6) and Biology (4). In fourth place, Portuguese was the most frequent (5). In fifth place, the most frequent subjects were Geography (4), History (3) and Chemistry (3). Exact science subjects, such as Mathematics and Physics, seem more important in the participants' lives.

The justification for placing the chosen subjects in the sequence they indicated was, for nine students, to organize them in descending order according to preference. Three said that the subjects were in the sequence of those they considered most important. One indicated that he/she ordered it according to priority criteria, another that he/she put it in alphabetical order, and another that he/she put it in the order of the subjects in which he/she is most interested. It was not possible to identify the theme in only three cases.

When considering the students' context, we can interpret a specific configuration of their life opportunities. However, when considering their experiences concerning the subjects, we can see that the students have much rapport with several of them, mainly those in exact and natural sciences, subjects many students find challenging. Furthermore, we can see that they not only feel comfortable with the subjects of the areas mentioned before, but they also feel an approximation with those in the humanities area, which influences their foregrounds. This

situation asserts that the foreground is a complex mix of personal and social factors (Skovsmose, 2014).

4.4 Students' foregrounds

Regarding conversations between students and their friends, we observe that 15 mentioned topics related to school issues. These school subjects included school activities, Olympiads, difficulties, the future, and mathematics. Furthermore, seven of those mentioned, along with two more students (A1N4 and A3N1), addressed topics beyond the school context, such as their personal lives, games, everyday events, and musical preferences. A8N2's answer was placed in the "Other" category, as he/she did not indicate a topic; he/she just commented that they talked "about everything."

It is noteworthy to say that all participants reported discussing the future with their friends. Some even emphasized this information by expressing "definitely" and said this was a constant theme. For example, A2N1 mentioned that these conversations occurred almost always; they were "scary" and "are even afraid of it."

Regarding themes, more than one was mentioned. Thus, nine students said their conversations included their expectations regarding university or finishing basic education. They also discussed the courses they planned to follow and their expectations regarding the entrance exams to higher education institutions.

Furthermore, eight students said they talked about what they wanted to become and the courses they planned to take. That means their plans relate to the higher education courses they intend to take, the professions they aspire to, and their dreams, aspirations, and expectations. Four students also mentioned discussing the professions they wanted to pursue, and three tried to imagine the future.

The students also stated that they talked about the future with their families, with ten indicating that these conversations only occur at specific times. In particular, mothers seem to be the interlocutors because they are more present in the house. This fact allows mothers to be closer to their children, which makes it easier for them to have a more open dialogue. Even though they mentioned that they talk to their family members, they made it clear that they are more open in their interactions with friends than with their parents and that conversations with friends are more frequent.

As for the question about the issues approached with their parents about the future, 17 students stated that they talked directly about their plans. In 16 of these answers, the content involved topics about professions, degrees, housing, and difficulties. Only one student did not say what were his/her plans. Only A8N4 did not say what he/she talked about with his/her family.

Regarding degrees, 13 students stated they discussed the courses they planned to take. For example, A3N2 commented that he/she discussed this with his/her family to get their opinion. Student A1N6, in turn, stated that his/her family members are the ones who "encourage him/her the most to have a good future," and A8N2 and A1N4 stated that they were making plans for the moment they completed a college degree.

Furthermore, seven participants stated that they talk about professions, with A8N1 and A1N6 mentioning that their mothers want them to pursue a medical career. A8N3 and A1N4 also discussed where they thought they would live, and A3N5 stated that they talked about the difficulties they would face.

The conversations covered various aspects that could favor the construction of students' foregrounds. By sharing their life experiences, aspirations, possibilities, and frustrations, students build their foregrounds and exert influence or are influenced by their colleagues and/or family members. The effects on a person's future outlook suggest that foregrounds can be changed, which shows that these moments of conversation, especially with their parents, are crucial for them (Skovsmose, 2014).

The chats revolved around their aspirations regarding the college they intended to take, the professions they intended to pursue, the difficulties they would face during graduation, the entrance exams they intended to take, and what they wanted to be in life. They tried to project what their lives would be like and what might happen in the future. We can also observe that students explored their foregrounds and the possibilities collectively. This may have happened because the foregrounds are formed through complex social processes and connect through several interactions (Skovsmose, 2014).

One issue identified was the distance between students and their parents. Of course, students spending more time at school causes such distance. However, parents need to participate in constructing their children's foregrounds, as they may suffer some intervention and eventually have them ruined. This is because the foregrounds are dynamic and, therefore, can be changed (Skovsmose, 2014).

For the students, their dreams and aspirations can be accomplished, as they commented on their plans for when they enter a higher education institution, which suggests that they are confident in achieving what they want. This is important, as a positive interpretation of the opportunities can strengthen their foregrounds (Skovsmose, 2014).

As for the future, they seem very hopeful. They believe that it will be promising, that it will be better. Only four students were doubtful (A8N4, A1N1, A1N5, and A3N1). Two of them were unsure about the course, one due to their profession and the other due to the National High School Exam (Enem). Despite the insecurity, one of them believes that, regardless of the choice he/she makes, it will work out.

Furthermore, ten students reflected on the higher education course they intend to take. Six also expressed the expectation of finding a job, and two expressed the desire to own a house. Only one mentioned the thought of building a family in the future. A8N5 thinks there is still a lot to learn before graduating. A8N1 also mentioned that he/she thinks he/she will be a less clumsy, more extroverted, calm, and average person, and A1N4 that he/she will have a good salary.

When analyzing the future, it is clear that they have good prospects. Some even presented more than one situation of how they projected themselves in the future. According to the answers, 11 students mentioned that they see themselves working, six in a better economic condition, seven graduating, five planning a family, and A1N6 seeing themselves as having "a good future." A8N1's answer was posted to Others, as he/she stated that he/she saw him/herself as less clumsy. Of the six students who stated that the future would be good or better, five mentioned education,i.e., that it could be better because they were studying or going to take a higher education course.

This concern about a good job indicates they intend to have a better job than the reference they already know. Having a good job involves both working conditions and financial issues. For example, A2N1 stated that the future he/she wanted was to live well and be successful enough to be able to repay everything his/her parents gave him/her. In turn, A3N1 said that he/she saw him/herself with a higher degree and pursuing a profession, in a better

living condition, as he/she and most of his/her friends came from an unsophisticated family. Their hope is based on the fact that they saw higher education as a possibility of changing their social situation, which strengthened their future.

Regarding the courses they wanted, six intended to study mathematics, as they liked the subject. Furthermore, three intended to study medicine as they identified with the area. One was thinking about studying military engineering, as he/she liked to know how things are done; another stated that he/she wanted to study economics, as it is an area that deals with numbers, and, therefore, he/she would know how to manage his/her money and that of the company he/she would work for. Another student stated that he/she was thinking about civil engineering, as it involves mathematics and physics and provides a financial return that would help his/her family.

Only six students were in doubt, but they had some options. One, for example, intended to study mathematics if he did well in Obmep. However, he/she was also thinking about medicine and veterinary medicine, as he/she liked those areas. Another student was unsure between physics and engineering but thought engineering was most likely because he/she liked to invent things. Another student stated that he/she intended to take a course in mathematics, civil engineering, architecture, or administration, as he/she really liked drawing plans, but he/she thought the choice would be civil engineering.

Two other students were in doubt about medicine and mathematics. One of them explained that he/she chose medicine because, when he/she was younger, he/she was a very sick child and, as he/she spent much time with doctors, he/she became interested in the area. He/She chose mathematics because he/she liked the subject. The other student wanted medicine influenced by a teacher and mathematics because he/she understands that he/she can do well and that he can change his/she future, but he/she could not explain how.

One student stated that he/she thinks about architecture, statistics, and programming. He/She chose architecture, influenced by other people and because it was possible to work close to their region; statistics, because he/she researched the Internet and saw that it was a very well-paid job in Brazil; and programming was something he/she liked to do.

When analyzing students' justifications for why pursuing a degree is in their plans, 12 participants stated that they believe that through college, they will get a job or it will be easier to get one. Furthermore, five students wanted their own money or better financial conditions. Furthermore, five wanted to be someone in life, have a better future, or succeed. Finally, one student stated that he/she wanted to delve deeper into the subject. Only three students (A8N1, A1N5, and A3N4) did not present an answer that was covered by any topic.

We can notice that their preferences influence their foregrounds. Furthermore, although their socioeconomic contexts indicate disadvantages, they are hopeful and confident that they will achieve what they want. This confidence seems to relate to the information they have because other students were in the same situation and successful in their plans. A person's future perspective can be influenced by friends, relatives, and colleagues (Biotto Filho, 2015).

As stated, students see a real possibility for education, particularly in mathematics. This area is a possibility for social advancement, and students believe that they can really change their lives. Therefore, we can also state that students' foregrounds are promising and present multiple characteristics. Furthermore, they provide reasons for involvement in educational activities since everyone aspires to take a higher education course and have demonstrated that they are convinced that education can offer better living conditions.

Furthermore, the profession students want to pursue requires intense dedication to

formal education. In other words, education is, for them, an effective means of achieving a more socially prestigious status and more qualified jobs. As students pursue areas related to mathematics, they engage in related activities, which leads us to infer that students see in mathematics the possibility of overcoming the social limits of the environment in which they are inserted.

4.5 Reasons to study mathematics

As for why they studied mathematics, six stated that they studied because it is a subject that is part of the curriculum. Including mathematics in the curriculum meets a need for learning this curriculum component for citizenship. It is a collective demand that ends up becoming individual.

Four students stated that the higher education course or profession they intended to choose requires them to master mathematical knowledge. Another indicated that he/she studies because he/she wants to stand out in the world, and another pointed out that he/she does it to "achieve his/her goals." Three students stated that they study because it is "fundamental for their daily lives." Finally, three gave answers that did not meet the question. Many participants studied mathematics because it was related to their future, whether because they would use it in higher education, at work, or in their daily lives, which contributed to their engagement in educational activities.

Students' concern with the future is related to a cultural need: the need for work. Consequently, this demand gives rise to other needs, one of which is learning. In the job market, people feel they must specialize more to stay in their activities or get better jobs. Besides, other needs, such as financial and social autonomy, influence the need for work and learning more intensely. A child or young person's career dreams can influence their decisions and participation in educational activities (Biotto Filho, 2015).

4.6 Needs for mathematics learning to use in life

When asked if they used numbers outside of school or did calculations, all students said yes, with eight saying they calculated while shopping. Three participants also indicated another situation. For example, A1N3 commented on using it to calculate some area or dimension. A8N4 and A1N2 stated that they also used it in games. A1N6 also said that he/she used mathematics in games.

Four students indicated random situations. For example, A8N2 counted the hours to be able to "take his/her medicine." Furthermore, three students stated that it was during commercial activities. For example, A3N1 stated that he/she helped his/her parents sell the nuts they collected; and A3N3 and A3N4 said they helped their father buy and sell meat. In turn, A8N1 stated that he/she used it to pay his/her mother's bills, and A1N1 used it to keep his/her accounts.

Regarding the types of calculations they performed in everyday situations outside of school, 16 students stated that they perform calculations that involve arithmetic operations, with A1N3 also indicating area calculations. A1N5 stated that he did counts, and A1N4 said he uses the rule of three or percentage calculations.

Everyone believes that learning mathematics is necessary for everyday life. However, there were several justifications. The justification with the most answers was that the person needs mathematics in many situations. Furthermore, four students stated that mathematics knowledge was necessary for some professions; five gave examples as answers, three related

to commerce, and two involved geometry. Furthermore, two students justified it by stating that it was necessary to know financial mathematics to do well when taking out a loan.

Based on what was said, they believe that it is necessary to learn mathematics to use it in everyday life. However, according to the examples given, such uses were limited. Most were limited to arithmetic questions. They recognized the importance of mathematics for everyday life but found it difficult to identify situations in which they could use it; almost all cited the same situations and content.

When answering whether mathematical knowledge could help them in the future, everyone said yes. However, when commenting on how it would help, 14 students believed that it could help them because of the profession they intended to pursue, whether in mathematics as a researcher or teacher or in areas that require mastering it. Furthermore, five students also mentioned that it would help them because of the course they intended to take. Another student also stated that it would help with the course he/she intended to take, and three stated that it would help them in future activities, whether daily or student, such as enrolling in a higher education course or even developing the course.

As an example of these future activities, A1N4 stated that it helps the person "both in terms of social life [...] and academics, which is getting a degree because mathematics is a very demanding subject." A1N6 said that "mathematics is one of the main subjects in Enem; everyone who has a good grade in mathematics usually has good grades in the rest of the subjects." The student also said that, for those who depended on Enem to enter college, having "knowledge of mathematics is very important," because, when "you get a good grade in mathematics, you can open new paths."

Thus, it is possible to see that, for students, studying mathematics is essential for their daily lives and their futures. Indeed, mathematics could be a differentiator in the selection for admission to higher education. However, it was possible to realize that mathematical knowledge would be more useful to them because of the work or course they intended to take than for an everyday situation.

Therefore, we must raise the following reflection: If students had seen this possibility of economic growth in another area, would they have wanted to learn mathematics? Probably just the basics to be able to take the entrance exam or to be able to use it in some situations. The issue is not just because he wanted to grow economically, but because he saw this possibility in mathematics because, if he/she finds this through education, it could be that any area or course he/she wanted would solve his/her need. Skovsmose et al. (2012) argue that students from a Brazilian favela see higher education as a possibility for changing their social situation.

Thus, based on Skovsmose et al. (2012) and Skovsmose (2014), we can infer that students are at the borders, where people can compare their conditions to other life possibilities. However, they see mathematics as a way to cross that border. From their statements, we realize that they can visualize what would be possible if they went across the border, which, in this case, is a better life. For them, school is the bridge across the border.

For the students who participated in this study, the possibility of crossing the border through education is not remote. They not only see that it is possible, but they also want it. All students, including those who stated that they are obliged to attend school, want to do it; they aspire to cross the social border that has excluded them, and they see education as that path, so they desire to go to school.

5 Conclusion

Based on teachers' perceptions of students and information related to the background made available, we realize that they were in risky socioeconomic contexts. However, when analyzing information related to the foreground, we noticed that they are promising and that it is paramount not only that students have dreams but also that they have real conditions to accomplish them.

The research data also indicated that the medal-winning students were influenced toward mathematics learning and that engagement in educational activities can be positively impacted. Because of these influences, we can say that students are in a border zone and, consequently, a conflicting zone as they begin to elaborate their foregrounds further and reflect on the possibilities of what could happen if they crossed this border position. Thus, to cross social and economic borders, students want to learn mathematics. This means that the teacher's role goes beyond guiding the construction of knowledge; the teacher guides students in constructing their foreground.

Students are motivated to learn mathematics because of their future, as they are very hopeful and attribute this to education. Thus, mathematical knowledge can help students more because of the course, profession, or future activities. In other words, work and professionalization requirements, impulsed by employment, which, in turn, were influenced by economic and social needs, motivate students to want to learn mathematics. Becoming aware of their economic and social conditions and possibly improving them through mathematics generated students' interest in learning the subject.

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