Informal use of mathematics in the classroom: The perspective of graduate students in Rural Education

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Abstract

The research carried out had the objective of analyzing the perspective of students of the Specialization Course in Rural Education in relation to the informal use of mathematics in the classroom. The informal use of mathematics in the classroom was addressed, focusing on a specific case involving a Youth and Adult Education (AYE) class. The qualitative case study was conducted with 8 participating students and took place remotely in June 2022, through the Google Meet platform. As an instrument, an online questionnaire with 6 open questions was used, which explored the participants' opinions about the attitude of a teacher and a student in a situation of disagreement regarding the use of formal mathematics as opposed to practical experience. The students' responses were analyzed and compared. The results indicate that the participants value both theoretical and practical knowledge and recognize the importance of dialogue and interaction between teacher and student. They also emphasize the need to balance theoretical and practical knowledge in the classroom and to value students' prior experience and knowledge. The study highlights the relevance of considering different educational perspectives and adapting the pedagogical approach to student needs and experiences, especially in AYE contexts.

Keywords: Ethnomathematics. Youth and Adult Education. Formal and informal mathematical knowledge. Interaction in the classroom.

Uso informal de las matemáticas en el aula: La perspectiva de estudiantes de posgrado en Educación Rural

Resumen

La investigación realizada tuvo como objetivo analizar la perspectiva de los estudiantes del Curso de Especialización en Educación Rural en relación al uso informal de las matemáticas en el aula. Se abordó el uso informal de las matemáticas en el aula, centrándose en un caso específico de una clase de Educación de Jóvenes y Adultos (EJA). El estudio de caso cualitativo se realizó con 8 estudiantes participantes y se llevó a cabo de forma remota en junio de 2022, a través de la plataforma Google Meet. Como instrumento se utilizó un cuestionario en línea con 6 preguntas abiertas, que exploró las opiniones de los participantes sobre la actitud de un docente y un alumno ante una situación de desacuerdo respecto al uso de las matemáticas formales frente a la experiencia práctica. Las respuestas de los estudiantes fueron analizadas y comparadas. Los resultados indican que los participantes valoran los conocimientos tanto teóricos como prácticos y reconocen la importancia del diálogo y la interacción entre profesor y alumno. También hacen hincapié en la necesidad de equilibrar los conocimientos teóricos y prácticos en el aula y de valorar la experiencia y los conocimientos previos de los alumnos. El estudio destaca la relevancia de considerar diferentes perspectivas educativas y adaptar el enfoque pedagógico a las necesidades y experiencias de los estudiantes, especialmente en contextos EJA.

Palabras clave: Etnomatemáticas. Educación de Jóvenes y Adultos. Conocimientos matemáticos formales e informales. Interacción en el aula.

Uso informal da matemática em sala de aula: A perspectiva de pós-graduandos em Educação do Campo

Resumo

A pesquisa realizada teve o objetivo de analisar a perspectiva dos estudantes do Curso de Especialização em Educação do Campo em relação ao uso informal da matemática em sala de aula. Foi abordado sobre o uso informal da matemática em sala de aula, com foco em um caso específico envolvendo uma turma de Educação de Jovens e Adultos (EJA). O estudo de caso qualitativo foi conduzido com 8 estudantes participantes e ocorreu de maneira remota em junho de 2022, por meio da plataforma Google Meet. Como instrumento foi utilizado um questionário online com 6 perguntas abertas, que exploravam as opiniões dos participantes sobre a postura de um professor e um estudante em uma situação de desacordo quanto ao uso da matemática formal em contraposição à experiência prática. As respostas dos estudantes foram analisadas e comparadas. Os resultados indicam que os participantes valorizam tanto o conhecimento teórico quanto o prático e reconhecem a importância do diálogo e da interação entre professor e estudante. Eles também enfatizam a necessidade de equilibrar o conhecimento teórico e prático em sala de aula e de valorizar a experiência e o conhecimento prévio dos estudantes. O estudo destaca a relevância de considerar diferentes perspectivas educacionais e de adaptar a abordagem pedagógica às necessidades e experiências estudantis, especialmente em contextos de EJA.

Palavras-chave: Etnomatemática. Educação de Jovens e Adultos. Conhecimento matemático formal e informal. Interação em sala de aula.

Initial Considerations

Mathematics is a subject present in basic education and has traditionally been approached in a formal manner in schools. Formal mathematics is characterized by the teaching and learning of concepts, theorems, axioms, and mathematical procedures through a structured and systematic approach. However, this approach is not always able to meet the needs of all students, especially in the context of Adult and Youth Education (AYE), where students bring life experiences and prior knowledge that can enrich the educational process.

On the other hand, informal mathematics is a practice present in people's daily lives and is closely linked to daily activities such as shopping, measuring distances, cooking, building, among others. Informal mathematics encompasses intuitive and practical knowledge that is built throughout life and is often developed independently of formal education. This approach is more flexible and adaptable to individual needs and experiences, allowing the understanding and application of mathematical concepts in a more contextual and meaningful way.

AYE, as a mode of education, aims to provide young people and adults who did not have the opportunity to complete their studies at the appropriate age with the possibility of resuming their education. AYE is characterized by being a differentiated modality, taking into account the specificities of this audience and their experiences and knowledge accumulated over a lifetime. In this sense, it is essential that the pedagogical approach adopted can value and articulate these experiences and knowledge in the teaching and learning process.

In this scenario, Ethnomathematics emerges as a pedagogical alternative that aims to value the cultural diversity and informal mathematical knowledge present in students' daily lives. Ethnomathematics, as a field of study, investigates the mathematical practices developed by different cultures and how these practices are inserted in a sociocultural, historical, and political context. By adopting this perspective, it is possible to build a more inclusive and emancipatory pedagogical approach that respects the diversity of students' knowledge and experiences and promotes the construction of mathematics that makes sense in their lives.

The relevance of Ethnomathematics in Mathematics Education has been highlighted by various authors and researchers, such as D'Ambrosio (1985; 2012; 2015), Fiorentini and Lorenzato (2006) and Moraes and Rolkouski (2008). These authors argue that Ethnomathematics can contribute to the deconstruction of knowledge hierarchies and the promotion of the valorization and articulation of different mathematical cultures in the

classroom. In addition, Ethnomathematics can contribute to overcoming specific challenges faced by AYE students, such as resistance and fear of mathematics, the need for contextualization of contents, and the valorization of their life experiences in the educational process.

In this regard, the objective of the research was to analyze the perspective of students from the Specialization Course in Rural Education regarding the formal use of mathematics in the classroom, based on the study of a case whose account originates from an AYE class. The report was published by Schneider (2010) in his doctoral thesis and Schneider and Fonseca (2014) in a scientific article. This type of analysis allows understanding how the Ethnomathematics approach can contribute to the construction of a more inclusive and contextualized pedagogy that values and articulates the informal and formal mathematical knowledge of AYE students.

This study was carried out in the Ethnomathematics discipline of the Specialization Course in Rural Education, offered by the Federal Institute of Mato Grosso (IFMT) Confresa Campus. The choice of this context is justified by the relevance of Rural Education as a mode of teaching that seeks to value and strengthen the cultural identity, knowledge, and practices of rural individuals, as well as to enable access to quality education for this population. In this sense, Ethnomathematics presents itself as a pedagogical approach aligned with the principles and purposes of Rural Education.

Throughout this article, the key concepts related to Ethnomathematics, formal and informal mathematics, and AYE will be presented, as well as the theoretical and methodological foundations that supported the case study. Then, the results obtained from the case study are discussed, highlighting the students' perceptions and reflections about the relationship between formal and informal mathematics in the classroom and the possible pedagogical implications of these relationships. Finally, conclusions and recommendations for educational practice and future research will be presented.

Inclusive and Emancipatory Mathematics Education through Ethnomathematics

The educational process, as argued by Santos (1996), is characterized by the conflict of knowledge, and the classroom transforms into a field of possibilities where students and teachers must make choices. In this context, it is essential to recognize the importance of engaging with reality, as Freire (1983) highlights. Commitment to reality is rooted in human existence itself and is fundamental to the development of true commitment.

In Mathematics Education, Fiorentini and Lorenzato (2006) affirm that praxis involves mastery of the specific content of mathematics and ideas and pedagogical processes related to transmission, assimilation, appropriation, and construction of school mathematical knowledge. In this sphere, Ethnomathematics, a term coined by Ubiratan D'Ambrósio (1985), emerges as an approach that emphasizes the importance of the sociocultural and political dimension in Mathematics Education.

D'Ambrósio (2015) clarifies that individuals and peoples create and develop instruments of reflection and observation (called "tics") to explain, understand, know, and learn to do (called "mathema") in response to survival and transcendence needs in different natural, social, and cultural environments (called "ethnos"). Thus, Ethnomathematics proposes to investigate and value the mathematical knowledge of marginalized cultural groups, which do not form part of a hegemonic culture or a dominant group (Moraes & Rolkouski, 2008).

From this perspective, knowledge is generated in response to distinct situations and is linked to historical, political, social, and cultural contexts. People construct their knowledge according to the reality they live in, and in this knowledge, their history, worldview, beliefs, myths, rituals, and notions of time and space are embedded (Knijnik, Wanderer, & Oliveira, 2006).

Ethnomathematics, therefore, seeks to problematize what has been considered as knowledge accumulated by humanity, emphasizing that the knowledge of other peoples, such as non-Europeans, non-whites, and non-urban, are often undervalued and considered as non-science. This devaluation occurs not because they are epistemologically inferior, but because they are not produced by those who, in Western society, are considered capable of producing science (Knijnik, Wanderer, & Oliveira, 2006).

School organization from the perspective of Ethnomathematics implies resizing school knowledge, considering the school not only as an institution responsible for the dissemination of scientific knowledge but also as a space for dialogue between different knowledge, incorporating a knowledge full of "life" (Monteiro, 1998). This does not exclude scientific knowledge but rather resizes it, allowing us to question why one aspect is emphasized over another, or why one knowledge is more valued than another.

According to Knijnik, Wanderer, and Oliveira (2006), academic Mathematics is a type of Ethnomathematics, as it is produced by a specific social group. The intention is not to glorify popular knowledge, but to give visibility to other mathematics silenced in school, as a cultural production of non-hegemonic groups.

D'Ambrosio (2015) asserts that one of the possibilities of the Ethnomathematics Program is to prioritize mathematical ways of explaining, knowing, and understanding knowledge across generations. In this sense, Ethnomathematics can be seen as a way to bring to light Mathematics practiced by different cultural groups and, therefore, becomes "[...] imbued with ethics, focused on recovering the cultural dignity of the human being" (D`Ambrosio, 2015, p. 9). He highlights that the term Ethnomathematics is not limited to the study of Mathematics of different ethnicities but includes varied cultural groups, such as urban and rural communities, groups of workers, professional classes, children of a certain age range, indigenous societies, and quilombola communities, among others.

D'Ambrosio (2012) emphasizes that the relationship between Ethnomathematics and the classroom is not established to nullify or reject academic Mathematics, but to make it something alive, dealing with real situations in time (now) and space (here). In this context, Godinho (2011) addresses real problems brought by AYE students in the classroom, justifying that this approach is a way to combat exclusion and value the mathematical knowledge brought by the students. Ethnomathematics is intrinsically related to AYE students, as they bring with them mathematical knowledge from their daily lives when returning to school or entering it in their adult phase.

Similarly, Passos (2008) suggests that the teacher's actions in the classroom be defined from the emerging doubts during the development of the content, since it is increasingly difficult to separate school mathematical knowledge from non-school knowledge. Thus, the approach to doubts and examples from students' daily lives occurs in sequence with the planned content. However, Santos et al. (2017) warn that addressing only aspects of the students' daily lives, without aiming to discuss and understand their generation and the ways in which they spread in their culture, can be a reduced form of using Ethnomathematical conceptions in the classroom.

Implementing the Ethnomathematics Program in the classroom requires a teaching practice that considers the mathematical knowledge present in students' daily lives and is committed to establishing connections between school mathematical knowledge and students' life experiences (Rosa & Orey, 2011). In this sense, the appreciation and articulation of different mathematical cultures in the classroom become fundamental for the construction of a more inclusive, critical, and emancipatory Mathematics Education (Valero, 2004).

The challenges encountered in the development of Ethnomathematics involve overcoming resistance to change on the part of teachers, teaching systems, and society in

general. It is necessary to reassess educational practices and recognize cultural diversity as a strength in Mathematics Education, rather than an obstacle (D`Ambrosio, 2015). Furthermore, it is important for teachers to be open to learning from their students, recognizing that mathematical knowledge is not something static, but dynamic, multifaceted, and constantly changing.

In summary, Ethnomathematics has the potential to promote a more inclusive Mathematics Education, engaged with the reality of students, by considering cultural diversity and the mathematical knowledge present in the daily lives of different social groups. By adopting an Ethnomathematical perspective, teachers can work to challenge and deconstruct knowledge hierarchies and promote the appreciation and articulation of different mathematical cultures in the classroom. In this way, Ethnomathematics contributes to the development of a Mathematics Education that seeks emancipation and the construction of a true commitment to the reality of students, as highlighted by Paulo Freire (1983).

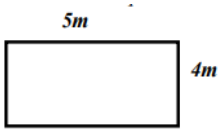
"You're a mason, aren't you?

The title of this section is the same as and refers to subsection 3.3.1 of the thesis "*Esse é o meu lugar... esse não é o meu lugar: relações geracionais e práticas de numeramento na Escola de EJA*" ("*This is my place ... this is not my place: generational relations and numeracy practices at the AYE School")* defended by Dr. Sonia Maria Schneider and guided by Dr. Maria da Conceição Ferreira Reis Fonseca. The thesis was conducted under the Graduate Program in Education linked to the Faculty of Education at the Federal University of Minas Gerais and defended in 2010. Its objective was to investigate the numeracy practices of students and teachers at an AYE public school in Rio Grande do Sul, from a sociocultural perspective.

The author seeks to understand how generational relationships between students and teachers influence numeracy practices in the AYE, taking into account the different experiences and knowledge that each group brings with them. For this, she carries out an ethnographic analysis of the school's daily life, using participant observation, interviews, and document analysis.

The research reveals that numeracy practices in the AYE are influenced by several factors, including the students' previous schooling, work experiences, and relationship with mathematics in everyday life. Furthermore, generational relationships between students and teachers also prove important, as students often feel embarrassed to participate in the activities proposed by the teachers, which can affect their learning.

For the development of the activity with the students of the Specialization Course in Rural Education during the Ethnomathematics discipline, who were the individuals researched, the following situation elucidated in the aforementioned thesis was used.

> It's six-thirty and there are still few students in the classroom. Joelton (33) was already sitting at his desk when Professor Gilberto, accompanied by the researcher, entered the room. This is the first day of observation of class 151 and, while we wait for more students to arrive, the professor and I talk about my research and the topic of ethnomathematics is brought up by the professor when referring to the formation of PEJA mathematics teachers who propose to organize themselves from this perspective. The topic brought by the professor also indicates a closeness between the professor and the researcher due to the fact that both know a teacher who acts as an advisor for the training of PEJA mathematics teachers.
> Suddenly, Professor Gilberto turns to the blackboard and begins the class, directing his gaze to student Joelton (33), who is sitting at the first desk in the row, which puts him very close to the blackboard:
> Professor Gilberto: You're a mason, aren't you?
> Joelton (33): I am.
> And, while he draws a rectangle on the board and indicates the dimensions of 5m and 4m, he asks;
>
> 
>
>
> Professor Gilberto: To lay a floor, without a baseboard, how many two-meter boxes will you need?
> Roberto (38): Twenty meters!
> Professor Gilberto [looking at Joelton]: Imagine that Sonia [looking at the researcher] called you to lay a floor in her house...
> While Professor Gilberto is paying attention to Joelton (33), other students arrive: Joane (23), Luciani (15), and Albanlce (46) start to chat animatedly. Albanice (46), who also sits, like Joelton (33), at the first desk in her row, and is closer to the professor and Joelton (33), when noticing that Professor Gilberto had put a problem on the board, interrupts the conversation with Joane (23) and Luciani (15) and tries to participate by risking an answer:
> Albanice (46): Four? Five?
> As she does not get a response from the professor, who addresses his words and gaze exclusively to student Joelton (33), Albanice (46) gives up on participating. Joelton (33), however, is unable to answer and seems distressed. Professor Gilberto changes his strategy: he goes to the board, points to the figure of the rectangle and the measurements and asks a question out loud, directing his gaze to "the class", but focusing again, at the end of the question, on student Joelton (33):
> Professor Gilberto: How many two-meter boxes do you need to do this?
> Joelton (33): [speaking quietly and looking only at Professor Gilberto]: Twenty?
> Professor Gilberto [looking at "the class"]: How many times does two fit into twenty?
> Albanice (46): One? Two?
> Roberto (38): Twenty?
> Joelton: Twenty?
> Roberto (38): Ten! It's ten!
> Professor Gilberto: Each box is two meters, so if I'm going to cover twenty meters, how many boxes will I need?
> And then he writes on the board:
>
> 2+2+2+2+2+2+2+2+2+2
>
> Professor Gilberto [counting, in order, each number two he wrote on the board]: one, two, three, four, five, six, seven, eight, nine, ten.
> Joelton [without leaving his place, calls the professor and speaks quietly]: I don't need to do math. I just need to know the area I'm going to cover. The seller at the

> hardware store is the one who does... There's a box of one and a half, there's a box of two...
> Professor Gilberto [goes back to the board and speaks loudly]: But, isn't it good to have some leftovers? Isn't there always some broken tiles?
> Joelton [speaks up]: Yes. A leftover of two suffices.
> Professor Gilberto [writing on the board]: And if I have eleven by two? [while speaking, the professor erases the measurements of the sides of the rectangle that was drawn on the board and replaces them with these new values]. What should be my leftover?
> Joelton: The same! Two meters!
> Professor Gilberto: What is the area of the rectangle?
> Joelton: Twenty-two meters.
> Professor Gilberto: So? What should be my leftover?
> Joelton: The same! Two meters is enough!
> Joelton and Professor Gilberto continue discussing the issue of leftovers. As the maximum arrival time for students is 7:30 pm, people are arriving while the class is happening. João (16) and Paula (17) arrive, and almost at the same time, Alzira (49). Joelton (33) and Professor Gilberto do not reach a consensus on the leftovers, since for Joelton (33) two meters is enough and Professor Gilberto considers and reaffirms that there should be proportionality between the area and the leftovers and that, therefore, the larger the area, the larger the leftovers should be...
> (Night of October 1st, Math class, researcher's field notebook notes) (Schneider, 2010, pp. 115-117)

Sonia Maria Schneider's thesis contributes to a broader understanding of numeracy practices in the AYE and suggests the importance of taking into account generational relations and the prior knowledge of students for a more effective teaching and learning process.

Qualitative Case Study with Ethnomathematics Students

The present case study adopts a qualitative approach to investigate the perceptions and experiences of eight participants who are students enrolled in the Ethnomathematics discipline in the Specialization Course in Rural Education offered by the IFMT Confresa Campus. The course was taught remotely in June 2022, through the Google Meet platform. The activity occurred by presenting the situation highlighted in the previous section with subsequent use of an online questionnaire.

The qualitative approach is appropriate for this study, as it allows for an in-depth understanding of the perceptions, experiences, and meanings attributed by students to their experiences (Creswell, 2010). This approach allows for exploring the complexities and nuances of the interactions between the participants and the educational context in which they are inserted (Bogdan & Biklen, 1994).

For data production, an online questionnaire developed in Google Forms was used, composed of six open-ended questions. Questionnaires with open-ended questions are data collection tools widely used in qualitative research, as they provide participants with the

freedom to express their opinions and experiences in a detailed and contextualized way (Sampieri, Collado, & Lucio, 2013). This approach allows researchers to capture rich and diverse information, which can be analyzed to identify patterns, themes, and relationships relevant to the purposes of the study (Bryman, 2016). The questions and the intentions with each one are set out in Table 1.

Table 1 - Questions that made up the questionnaire with their respective intentions

Question	Intent
Question 1: What did you think of Professor Gilberto's attitude?	Understand the participants' perception of Professor Gilberto's posture, analyzing whether they consider it appropriate or not, and whether this attitude facilitates or hinders the teaching-learning process.
Question 2: What did you think of Joelton's attitude?	Understand the participants' opinion on Joelton's attitude, assessing whether they believe he is contributing to the debate and knowledge construction, or if he is hampering the classroom dynamics.
Question 3: Do you believe that Professor Gilberto is correct in thinking that a proportional surplus needs to be calculated for the area to be covered?	Verify whether the participants agree with Professor Gilberto's perspective, i.e., if they believe that the calculation of the proportional surplus to the area to be covered is necessary, and if this approach is relevant in the given context.
Question 4: Do you believe that the student Joelton is correct in thinking that a surplus of 2m² is needed for both situations presented?	Identify whether the participants agree with Joelton's perspective on the need for a fixed surplus of 2m² for the two situations presented, and if they consider this approach appropriate and based on their experiences.
Question 5: In your opinion, do these disagreements between teacher and student occur frequently in the classroom?	Why do they occur? Investigate the participants' perception of the frequency of disagreements between teachers and students in the classroom, as well as understanding the reasons why they believe these disagreements occur.
Question 6: Have you ever witnessed a similar situation in the classroom where the teacher relies only on theory and the student relies on their experience?	Collect participants' accounts of similar situations they have witnessed in the classroom, where there are discrepancies between the theory discussed by the teacher and the student's experience, in order to understand how these situations were managed and what impact they had on the educational process.

Source: Data from the activity performed.

The data produced through this questionnaire are presented and an analysis is carried out exploring the participants' perceptions of the interaction between the formal mathematics taught in school and the informal mathematics stemming from students' practical experiences.

Analysis of Student Perceptions: Exploring the Interaction between Formal Mathematics and Practical Experience

The responses provided by the participants to the six questions of the questionnaire used are presented. There is exploration of the participants' perspectives on the relationship between formal and informal mathematics, as well as their understandings in the context of Ethnomathematics.

Regarding *Question 1: What did you think of Professor Gilberto's approach?*, the following answers were given.

> Student 1: I believe that at the same time the professor encourages the student to participate in class, there is a bit of doubt about Joelton's knowledge.
> Student 2: He was evasive in trying to express that only his method is correct. And he did not accept the way his student solved the problem.
> Student 3: I think he wanted to involve the student.
> Student 4: In my view, Professor Gilberto did not agree with Joelton's way of thinking, even though Joelton was just using his prior knowledge, that is, ethno-knowledge. The professor, on the other hand, was based on scientific knowledge, that is, a lot of theory and for this reason questioned the fact that he does not know mathematics, how would he know the necessary amount of floor to be used.
> Student 5: He is right, but he should consider and give spaces for Joelton to speak and show what he knows.
> Student 6: The professor's posture is not coherent, because the professor must be flexible with adult education students, once this student feels hostile, humiliated, the student will not return to school.
> Student 7: Professor Gilberto was a strategist in proposing a didactic approach in which he problematized a situation in the context in which the student was inserted to subsidize the teaching of mathematical concepts, recognizing that the student has mathematical knowledge built on his work experience, thus, he seeks to articulate these knowledges with academic knowledge.
> Student 8: In my opinion, the professor, by assuming a professional posture, wanted to facilitate the student's learning process, since Joelton is an adult and has mathematical knowledge derived from his work experience as a bricklayer.

Upon analyzing the participants' responses regarding Professor Gilberto's demeanor, a diversity of opinions can be perceived. Some answers, such as those of Students 1, 3, 7, and 8, present a more positive perspective, indicating that the professor seeks to engage the student and use Joelton's experience as a bricklayer to facilitate the learning process and articulate academic knowledge with the student's prior knowledge.

On the other hand, the responses from Students 2, 4, 5, and 6 reveal a more critical perception of the professor's demeanor. These participants believe that Professor Gilberto

may have been evasive, inflexible, and even inconsistent in dealing with Joelton's prior knowledge, without giving enough space for the student to express his experience and demonstrate his ability to solve the problem.

This observation highlights a tension between the formal approach to mathematics and Ethnomathematics. The formal approach, represented by Professor Gilberto, is based on scientific and theoretical knowledge, while Ethnomathematics, present in Joelton's experience, values prior knowledge and students' practical experience.

According to Valero (2004), it is important that the teacher acknowledges and values the prior knowledge and experience of students, especially in AYE contexts, where students have cultural baggage and experiences that can enrich the teaching-learning process. In this sense, it is crucial that the teacher adopts an open and flexible demeanor, allowing students to express and share their experiences, and striving to articulate this knowledge with academic learning.

Therefore, the participants' responses indicate the need for greater sensitivity on the teacher's part regarding the diversity of knowledge and respect for students' experience. This includes giving room for students to contribute with their experiences and seeking ways to integrate prior knowledge into the formal curriculum, promoting a more inclusive and contextualized approach to mathematics.

The answers to *Question 2: What did you think of Joelton's demeanor?* are presented next.

> Student 1: As a student, I believe he was correct.
> Student 2: Joelton was somewhat inflexible with his response since he knows from practice and not calculations.
> Student 3: He was hesitant to respond.
> Student 4: Confident. Since he was sure of what he was talking about, showing the teacher that he didn't need to know mathematics to determine the amount of floor that he would use.
> Student 5: He was direct, but he was afraid of making a mistake.
> Student 6: His attitude was somewhat participative, because he answered the questions, while others, due to their fear of wrong answers, don't even respond.
> Student 7: Despite Joelton having mathematical knowledge about the content under study, he lacks confidence and somehow failed to correlate the problem situation.
> Student 8: Student Joelton had a bad attitude, because he refused to learn, claiming he doesn't need to calculate.

Some participants, such as Students 1, 4, and 6, view Joelton's demeanor as correct and confident, highlighting his participation and willingness to share his practical knowledge, even in a context where formal mathematics is privileged.

However, other participants have a more critical view of Joelton's demeanor. Students 2 and 8, for example, consider that Joelton was inflexible and even negative, since he refused to learn and consider the formal approach of mathematics. Students 3, 5, and 7, on the other hand, perceived that Joelton demonstrated fear and lack of confidence in responding to the problem situation, possibly due to the pressure of being in an environment where his prior knowledge and practical experience are not valued.

Based on Rosa and Orey (2011), it is important to understand that Joelton's demeanor reflects a tension between formal mathematics and Ethnomathematics. While formal mathematics is based on theoretical and scientific knowledge, Ethnomathematics values the practical experience and prior knowledge of students. In this context, Joelton attempts to assert the validity of his practical knowledge, despite facing barriers and challenges imposed by the formal approach to mathematics conducted by Professor Gilberto.

To promote an inclusive and efficient learning environment, it is crucial that the teacher is able to recognize and value the diversity of knowledge and experiences present in the classroom. This involves creating opportunities for students to share their experiences and integrating these insights into the teaching and learning process, establishing connections between formal mathematics and Ethnomathematics.

Therefore, based on the participants' responses regarding Joelton's demeanor, the need to rethink the way mathematics is approached in the classroom can be highlighted, seeking to value students' prior knowledge and experience, and promoting a more inclusive and contextualized approach to mathematics teaching.

For *Question 3: Do you believe that Professor Gilberto is correct in thinking that it is necessary to calculate a surplus proportional to the area to be covered?*, the following responses were given.

> Student 1: If we think from both of their knowledge, which are different, he [Joelton] talks about this calculation all the time, but he never shares these data.
> Student 2: Yes.
> Student 3: Yes, because there is a possibility of breaking some piece or even making a wrong cut.
> Student 4: Yes. In the methodology, the professor understood that the larger the area to be covered, the greater the leftover should also be.
> Student 5: Yes. Calculating is important so there are no errors or material losses.
> Student 6: He is right in the care to demonstrate the applications of mathematics, what was missing was a demeanor with the adult audience, as today's students are very sensitive. The teacher could demonstrate the mathematical calculations without trying to alienate the student.

> Student 7: I believe that Professor Gilberto's intention was to stimulate the student to think.
> Student 8: No, because I believe that this could cause potential waste.

The participants' answers to question 3 about the need to calculate a surplus proportional to the area to be covered, according to Professor Gilberto, show varied opinions. The majority of participants, Students 1, 2, 3, 4, 5, and 7, agree with the professor's approach, highlighting the importance of performing calculations to avoid errors and losses of materials. They also emphasize the professor's intention to stimulate the student to think and consider different perspectives.

However, Students 6 and 8 present divergent opinions. Student 6 agrees with the importance of mathematical calculations but criticizes the teacher's demeanor regarding the adult education audience. Student 8, on the other hand, disagrees with the need to calculate a proportional surplus, arguing that this could lead to waste.

One can understand that Professor Gilberto's perspective is aligned with formal mathematics, which emphasizes the importance of calculations and formulas to solve problems. However, according to D'Ambrosio (2012; 2015), it is essential also to consider the Ethnomathematics approach, which values the experience and prior knowledge of students, like Joelton, who advocates a fixed surplus of 2m² for the two situations presented.

Therefore, the observation of the participants' responses to question 3 indicates that, although Professor Gilberto's approach may be valid in terms of formal mathematics, it is essential also to consider the Ethnomathematics perspective and the students' experience, promoting a more inclusive and contextualized mathematics teaching.

The responses related to *Question 4: Do you believe that student Joelton is correct in thinking that a surplus of 2m² is necessary for both situations presented?*, are presented below.

> Student 1: I believe that from his knowledge, as a bricklayer, perhaps yes.
> Student 2: Yes, he is a bricklayer and knows from practice that two meters are sufficient.
> Student 3: Yes.
> Student 4: Yes. Because he debated a situation which was his field of work, that is, Joelton used the prior knowledge he had.
> Student 5: Yes. He has the day-to-day experience.
> Student 6: Yes. He is a learner.
> Student 7: Due to the experience gained at work, Joelton knows that only a surplus of 2m² is necessary. Therefore, in his view, he does not need to perform mathematical calculations.
> Student 8: Yes, because he states it based on his experience.

The participants' answers to question 4 show a consensus regarding Joelton's opinion, who defends the need for a 2m² surplus for both situations presented. Everyone agrees with this perspective, highlighting his practical experience and prior knowledge as a bricklayer.

Based on the principles presented by Godinho (2011) about approaching real situations in the classroom, Joelton's approach aligns with Ethnomathematics, which values the knowledge and experience gained in everyday life and in specific work contexts. The participants recognize the validity of this perspective and the importance of considering it in teaching mathematics.

Based on the participants' responses, support for the ethnomathematical approach can be revealed, emphasizing the need to value students' experience and prior knowledge in the teaching-learning process. This implies promoting a dialogue between formal mathematics and Ethnomathematics, in order to build a more inclusive, contextualized, and meaningful mathematics education for students.

Therefore, the participants' responses to question 4 indicate that Joelton's perspective, based on Ethnomathematics, is considered valid and relevant by the participants. According to studies by Passos (2008), this reinforces the importance of integrating different approaches in mathematics teaching, especially in contexts like adult education, where students have experiences and prior knowledge that can be mobilized for the construction of mathematical knowledge.

With *Question 5: In your opinion, does this situation of disagreement between teacher and student occur frequently in the classroom? Why do they occur?*, the following answers were obtained.

> Student 1: Yes. Because if we consider the learning process, there can be uncertainty and doubt, as the teacher does not own the truth, and students, when they know how to deal with their knowledge, can present a curious and questioning attitude.
> Student 2: Yes. Because teachers usually cling too much only to the scientific method and want the answers accordingly, while students, through empirical experiences...
> Student 3: Yes. Because they are distinct opinions. This exchange enriches the class.
> Student 4: Yes. And it happens because we are talking about human beings, so each one has their own opinion and way of seeing and understanding.
> Student 5: Yes, it always happens, sometimes the teacher does not know the practice.
> Student 6: Yes. Today we are in an era where nobody has humility, and everyone is mentally ill, no one wants to give in, there is no peaceful spirit, the human being is full of 'I', I do, I am right.

> Student 7: Yes, because usually students always defend their knowledge and their way of thinking, teachers need to deal with the situation in a way that favors the student's teaching and learning.
> Student 8: Yes, they often occur due to divergence of thoughts, difficulty of the student to understand explanations from teachers, among others.

The participants' answers to question 5 indicate that, in their opinion, situations of disagreement between teachers and students occur frequently in classrooms. Various reasons are pointed out to explain why these disagreements occur, which include diversity of opinions, experiences, and teaching approaches.

Furthermore, some participants highlighted the importance of dialogue, humility, and appreciation of different knowledge and perspectives in the teaching and learning process. This view corroborates with what was elucidated by Knijnik, Wanderer, and Oliveira (2006) and indicates the need to build a more inclusive and democratic educational environment, where students' voices and experiences are recognized and respected.

Thus, the participants' responses to question 5 suggest that disagreements between teachers and students can be overcome through a pedagogical approach that promotes dialogue, values diversity, and integrates formal and informal mathematics. In this way, it is possible to create a learning space where students and teachers can learn from each other and build mathematical knowledge collaboratively and contextually.

As answers to *Question 6: Have you ever witnessed a similar situation in the classroom, where the teacher relies only on theory and the student relies on their experience?*, the following were obtained.

> Student 1: Yes.
> Student 2: Yes, mainly in calculations where students simplify formulas.
> Student 3: Yes.
> Student 4: Yes. Especially when addressing issues related to ethno-knowledge.
> Student 5: Yes. At the university, a microbiology professor seriously argued with a student.
> Student 6: Yes, we have to value the student's practice, the student's common sense knowledge, they are wise in the knowledge acquired from generation to generation.
> Student 7: Yes.
> Student 8: Yes.

The answers to question 6 show that all participants have witnessed a situation in the classroom where there is a disagreement between the theoretical approach defended by the teacher and the student's experience. These conflicts can arise in different contexts and areas

of knowledge, such as mathematics, ethno-knowledge, and microbiology, as exemplified by the participants.

As an alternative to addressing these conflicts in the classroom between theoretical assumptions and individual experience, D'Ambrosio (2015) suggests that it is necessary to recognize and value the empirical knowledge and experience of students, as well as promote dialogue and collaboration between teachers and students. In this way, it is possible to create a more meaningful and efficient learning environment, where the teaching of mathematics is contextualized and related to the students' daily practices.

In general, the participants point out the importance of balancing theoretical and practical knowledge in the classroom and valuing the experience and prior knowledge of students. They also highlight the need for dialogue and interaction between teacher and student to create a enriching and effective learning environment.

Final considerations

From the analysis of the participants' perceptions about the teacher's and student's attitudes, as well as their experiences in similar situations in the classroom, it is believed that the research was successful in its objective to analyze the perspective of the students of the Specialization Course in Rural Education regarding the formal use of mathematics in the classroom.

Throughout this work, participants' responses to the six questions in the questionnaire were analyzed, which revealed different perspectives on the attitudes of teacher Gilberto and student Joelton, the importance of formal mathematics and practical experience, and the possible causes of disagreements in the classroom. The analyses pointed out that participants value both theoretical and practical knowledge, recognizing the importance of both approaches in the teaching and learning process.

The discussions and reflections led to the understanding that the integration of formal and informal knowledge is essential for a more inclusive and welcoming education. Ethnomathematics presents itself as an approach that can assist in connecting theoretical knowledge and the practical experiences of students, valuing different ways of learning and contributing to the development of skills and competencies relevant to students' lives.

It is concluded, therefore, that it is important for teachers to be aware of classroom dynamics and seek ways to promote the integration of formal and informal mathematics, recognizing and valuing the diversity of students' knowledge and experiences. This approach may result in more effective and engaging teaching, favoring the development of critical and

reflective skills, and promoting inclusion and the recognition of different forms of knowledge in the educational context.

It is hoped that this article will contribute to the debate about the role of Ethnomathematics in Mathematics Education, especially in the context of adult education, and will encourage reflection and dialogue among researchers, teachers, and students about the possibilities and challenges of constructing a pedagogy that values and articulates formal and informal mathematical knowledge in the classroom. In addition, the importance of valuing cultural diversity and students' prior knowledge as fundamental elements for constructing an emancipatory and inclusive Mathematics Education is highlighted.

Finally, in the interaction between teacher Gilberto and student Joelton, there is no right or wrong side, as both bring valuable contributions to the educational process. It is important to recognize that knowledge coming from the students' experience should not be ignored or separated from the mathematical experience in the classroom. On the contrary, it is fundamental to integrate and value students' empirical wisdom, building a bridge between their experiences and the formal concepts of mathematics, in order to enrich the teaching and learning process and promote a deeper and contextualized understanding of the content covered.

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