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The voice of teaching: constructing bridges with conversations about interdisciplinarity and equity

La voz de la docencia: construyendo puentes con diálogos sobre interdisciplinariedad y equidad

La voix de l'enseignement : bâtir des ponts avec des dialogues sur l'interdisciplinarité et l'équité

A voz da docência: construindo pontes com diálogos sobre interdisciplinaridade e equidade

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Abstract

This study presents discussions on the professional development of teachers from a perspective that integrates teacher training, interdisciplinarity and equity. It is characterized as qualitative research, through the Foucault's discourse analysis, with a methodology based on elements of collaborative research, and took place in a public school with the participation of a Mathematics teacher from Elementary School II. This research was articulated through the Northeast Mathematics Education Network (REM-NE), which has as participants researchers from several universities and schools in the Northeast region. The main goal was to analyze the perception of the Mathematics teacher regarding interdisciplinary teaching based on equity and its potential in terms of overcoming inequalities in the learning of students with different curricular realities in a process of professional development. The obtained results show that, even with a degree in interdisciplinary teaching, the teacher still faces challenges in

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terms of putting into practice what was studied at university. Thus, the difficulties permeate teachers of disciplinary and interdisciplinary courses. As for equity, the research carried out in this work showed that there are still many advances and challenges to be overcome for the effective teaching of Mathematics. The process involves several structural, curricular, training and postural factors in the face of diversity and adversity. Based on the considerations of the participating teacher, we perceived that there is an awareness of the importance of reflecting more on these themes, especially when it comes to teaching during Mathematics classes.

Keywords: Professional development, Interdisciplinarity, Equity, Teacher training, Mathematics teaching.

Resumen

Este estudio presenta discusiones sobre el desarrollo profesional de los docentes desde una perspectiva que integra la formación docente, la interdisciplinariedad y la equidad. Se caracteriza por ser una investigación cualitativa, a través del análisis del discurso foucaultiano, con una metodología basada en elementos de investigación colaborativa y se desarrolló en una escuela pública con la participación de una profesora de Matemáticas de la Escuela Primaria II. Esta investigación se articuló a través de la Red de Educación en Matemáticas del Nordeste (REM-NE), cuyos participantes son investigadores de varias universidades y escuelas del Nordeste. El objetivo principal fue analizar la percepción del docente de Matemática sobre la enseñanza interdisciplinaria basada en la equidad y su potencial para superar las desigualdades en el aprendizaje de estudiantes con diferentes realidades curriculares en un proceso de desarrollo profesional. Los resultados obtenidos muestran que a pesar de graduarse en una carrera interdisciplinaria, la docente aún enfrenta desafíos para poner en práctica lo estudiado en la universidad, por lo que las dificultades permean a los docentes de cursos disciplinarios e interdisciplinarios. En materia de equidad, la investigación realizada en este trabajo demostró que aún quedan muchos avances y desafíos por superar para enseñar Matemáticas de manera efectiva. El proceso involucra varios factores estructurales, curriculares, formativos y actitudinales ante la diversidad y la adversidad. A partir de las consideraciones del docente participante, nos dimos cuenta de que existe una conciencia de la importancia de reflexionar más sobre estos temas, especialmente cuando se trata de la enseñanza en las clases de Matemática.

Palabras clave: Desarrollo profesional, Interdisciplinariedad, Equidad, Formación docente, Enseñanza de las matemáticas.

Résumé

Cette étude présente des discussions sur le développement professionnel des enseignants dans une perspective qui intègre la formation des enseignants, l'interdisciplinarité et l'équité. Il s'agit d'une recherche qualitative, à travers l'analyse foucaldienne du discours, avec une méthodologie basée sur des éléments de recherche collaborative et qui s'est déroulée dans une école publique avec la participation d'un professeur de mathématiques de l'école primaire II. Cette recherche a été articulée par le biais du Northeast Mathematics Education Network (REM-NE), dont les participants sont des chercheurs de plusieurs universités et écoles du Nord-Est. L'objectif principal était d'analyser la perception des enseignants de mathématiques concernant l'enseignement interdisciplinaire basé sur l'équité et son potentiel pour surmonter les inégalités dans l'apprentissage d'élèves ayant des réalités curriculaires différentes dans un processus de développement professionnel. Les résultats obtenus montrent que même si elle a obtenu un diplôme interdisciplinaire, l'enseignante fait toujours face à des défis dans la mise en pratique de ce qui a été étudié à l'université, de sorte que les difficultés imprègnent les enseignants des cours disciplinaires et interdisciplinaires. En ce qui concerne l'équité, les recherches menées dans ce travail ont montré qu'il reste encore de nombreux progrès et défis à surmonter pour enseigner efficacement les mathématiques. Le processus implique plusieurs facteurs structurels, curriculaires, de formation et d'attitude face à la diversité et à l'adversité. Sur la base des réflexions de l'enseignant participant, nous avons réalisé qu'il existe une prise de conscience de l'importance de réfléchir davantage sur ces thèmes, notamment lorsqu'il s'agit d'enseigner dans les cours de mathématiques.

Mots-clés: Développement professionnel, interdisciplinarité, Equité, Formation des enseignants, Enseignement des mathématiques.

Resumo

Este estudo apresenta discussões sobre o desenvolvimento profissional de professores/as a partir de uma perspectiva que integra a formação docente, a interdisciplinaridade e a equidade. Caracteriza-se como pesquisa qualitativa, através da análise foucaultiana do discurso, com metodologia baseada em elementos da pesquisa colaborativa e ocorreu em uma escola pública com a participação de uma professora de Matemática do Ensino Fundamental II. Esta pesquisa foi articulada por meio da Rede Educação Matemática Nordeste (REM-NE), que tem como participantes pesquisadores/as de diversas universidades e escolas do Nordeste. O objetivo principal foi analisar a percepção da professora de Matemática a respeito do ensino

interdisciplinar pautado na equidade e suas potencialidades na superação de desigualdades na aprendizagem dos/as estudantes com realidades curriculares distintas em um processo de desenvolvimento profissional. Os resultados obtidos evidenciam que mesmo sendo formada em uma licenciatura interdisciplinar a professora ainda enfrenta desafios para pôr em prática o que foi estudado na universidade, sendo assim as dificuldades perpassam docentes de cursos disciplinares e interdisciplinares. No que se refere a equidade, as pesquisas realizadas neste trabalho mostraram que ainda há muitos avanços e desafios a serem vencidos para a efetivação no ensino de Matemática. O processo envolve diversos fatores estruturais, curriculares, de formação e de postura frente às diversidades e adversidades. A partir das considerações da professora participante, percebemos que existe a conscientização da importância de refletirmos mais sobre essas temáticas, principalmente tratando-se do ensino nas aulas de Matemática.

Palavras-chave: Desenvolvimento profissional, Interdisciplinaridade, Equidade, formação docente, Ensino de matemática.

Research has the ability to provide support for teachers' decision-making and promote equitable pedagogical practices, allowing students to understand and transform their social reality. In this sense, the Northeast Mathematics Education Network (REM-NE, as per its Portuguese acronym), composed of researchers from several universities, has developed research focused on professional training, with the goal of subsidizing Mathematics and Science teachers, thus improving their pedagogical practices to ensure student learning.

This research continues in line with two previous ones: Professional Development of Teachers who teach Mathematics (2018 - 2019) and Professional Development of Mathematics teachers and the Teaching of Statistics in Elementary School (2019 - 2022). These projects were developed within the scope of the Northeast Mathematics Education Research Network (REM-NE), in collaboration with 11 Higher Education institutions, including the Federal University of Cariri (UFCA), located in five states in the Brazilian Northeast region and one in the Brazilian Southeast region. In addition, they have a partnership with municipal public schools distributed in these states.

With regard to issues related to the quality of Education, the Sustainable Development Goals (SDGs) indicate that each country must "ensure inclusive, equitable and quality Education and promote lifelong learning opportunities for all" (UNESCO, 2016, p. 82). Therefore, there is a need to focus on the students' learning needs, enabling the development of skills and competencies foreseen in their training itinerary, respecting the diversity of classrooms, that is, the different levels of knowledge, social environments and learning rhythms of each student. In this sense, for the equitable learning of students, there is a need to consider this heterogeneity.

Through its function of providing students' learning experiences and supporting their social transformation, the school can offer resources and methodologies that provide equity in the promotion of teaching quality. This situation favors the development of concepts and better conditions for the active participation of students in society, questioning political and socioeconomic decisions. Currently, Mathematics is one of the areas used to better understand and propose solutions to problems that ravage society.

The Brazilian National Common Curriculum Base (BNCC, as per its Portuguese acronym), a normative document for the preparation of curricula in Brazilian schools, is an initiative provided for in the Law of Guidelines and Bases (Brasil, 1998), which aims to promote the democratization of education (Brasil, 2018). Studies have shown that this

document aims to standardize curricula and contest their purpose (Silva & Silva, 2021), as they do not provide inclusive processes, nor do they meet the individual demands of different regions of the country. Therefore, it is important that each school, under the support of the municipal network, construct its own curriculum, since this is a way to promote equity.

In this sense, learning serves as a tool for humanization in research on Mathematics Education and other areas of knowledge. Teaching Mathematics is too complex to be reduced to a list of basic skills, or even to pre-added procedures. There is an increasing need to consider that learning is related and connected to the contexts experienced by students (Lave, Wenger, 1994; Cobb, 2000).

The current research proposal considers the problems highlighted here, as well as the potential of Mathematics curricula that value interdisciplinarity, equity, creativity, investigation, knowledge of the student's own reality, besides the mastery of concepts by students. Thus, it supports students to have critical and equitable learning.

Within this context, in the professional development of the educator, we seek to identify learning experiences that can contribute to the mastery of professional competencies with regard to the practices implemented in the classroom, focusing on the following research question: How can a professional development process contribute to overcoming inequalities in student learning, focusing on equity and different curricular realities? In view of the above, we highlight the main goal: To analyze the perception of a Mathematics teacher regarding interdisciplinary teaching underpinned by equity and its potential in terms of overcoming inequalities in the learning of students with different curricular realities in a process of professional development.

Teacher's professional development: a theoretical look at Interdisciplinarity and equity in teacher education

In the current work, we will discuss Professional Development. From this perspective, Imbernón (2011, p. 60) suggests that "from non-technical perspectives, knowledge in relation to the exercise of teaching in every teacher is fragmented at various times". It lists four non-technical perspectives: experience as a student; professional socialization; professional experience and continuing training. Such perspectives encompass more than the teacher's initial training, as knowledge will be involved in contexts, such as the teacher's action in the classroom.

In the same direction, Ponte (2012, p. 89) contrasts what can be understood by training and professional development, considering that "training tends to be seen as a movement

‘from the outside in’ [...], while professional development represents a movement ‘from the inside out’”. Training is seen as an external factor, which can be punctual, generated by other external agents, and professional development is broader, as it involves the teacher in its cognitive, affective and functional aspects, has internal motivations and can provide the teacher’s autonomy in the classroom.

Day (2001, p.85) warns about the efforts that have been made in teacher training, in order to enhance student learning and the need to provide constant continuing education, so that educators “[...] can update their knowledge of the content and continue to develop strategies related to classroom organization and evaluation. We consider these points important for teacher training and agree with the author, when he defends professional development and the importance of learning from others in his/her own workplace.

Professional development involves all spontaneous learning experiences and consciously planned activities, carried out for the direct or indirect benefit of the individual, the group or the school, which contribute, through these factors, to the quality of education in the classroom. It is the process through which teachers, as agents of change, review, renew and expand, individually or collectively, their commitment to the moral purposes of teaching, acquire and develop, in a critical way, together with children, young people and colleagues, the knowledge, skills and emotional intelligence, essential for effective professional reflection, planning and practice, at each stage of their professional lives (Day, 2001, p. 20-21).

Clarke and Hollingsworth (2002) present a model to describe the teacher’s professional development process and enables collaborative group work. Its structure allows us to analyze a formative process in four different domains: (i) external domain (source of information, stimulus and support), in this research, it is the REM-NE that acts as an external domain; (ii) mastery of practice (professional experimentation); (iii) domain of consequence (in terms of student learning); and (iv) personal domain (includes knowledge, beliefs and attitudes on the part of the teacher).

Based on the REM-NE research, this model was reviewed and expanded, according to Santana, Couto and Paula (2021). In the formative model that the REM-NE inserts the action of university-school leadership (USL), leadership contributes to negotiations among the university (researchers), the school management and the teacher, so that they provide the effectiveness and (re)construction of theoretical and methodological concepts, as well as the plans prepared with the teachers during the formative meetings.

From the negotiations implemented by the leadership with the teachers, it is possible for them to reflect on the planning and changes in their teaching practice, as well as on the expected results in terms of student learning, thus resulting in a pedagogical practice with an approach in the classroom or outside it, which seeks to facilitate and support the learning of all students with regard to content knowledge, as well as the social context in which they are inserted, defining their goals and purposes. Pedagogical practice "is a dimension of social practice that presupposes the relationship between theory and practice, and it is essentially our duty, as educators, to seek the required conditions for its achievement' (Veiga, 1989, p.16), being an approach in the classroom or outside it. It is important to provide a practice that can provide equity for student learning.

Researchers from the REM-NE have prepared a concept map regarding equity for learning mathematical concepts. This is a theoretical framework for classroom work, which guides opportunities and support for equity relationships in the learning of Mathematics concepts. The provision of interdisciplinary actions with methodological resources enables students to understand and transform their social reality. The concept map has a dialectical model among Expressing - Providing - Achieving expectations. In order to express is to give the student the opportunity to demonstrate his/her learning. The act of propitiating deals directly with the pedagogical practice assumed for working with mathematical concepts, where it is essential to plan opportunities to access the mathematical concept, such as: problem-situations, use and production of software and situations with themes of interdisciplinary actions.

Achieving expectations, both in the advancement of the schooling process and in positions, is related to decisions in and for life in the local and global community, in their professional choices, in their arguments, communication, reasoning, in possibilities of constructing new knowledge and in their achievements as citizens. This involves knowledge beyond the disciplinary aspect, thus requiring the implementation of interdisciplinary attitudes (Santana & Castro, 2022).

These dialectical relationships involve dimensions of knowledge and human nature: an attitude of seeking alternatives to know in conversation with other areas of knowledge and human activity; attitude of waiting, humility, reciprocity, challenge, involvement, commitment and responsibility with life (Fazenda, 2001), with teaching, learning, training and research. Attitudes indicate that learning and knowing is a privilege of all people regardless of color, race, sex and nationality. In this sense, Fazenda (2001, p. 159) says that "the interdisciplinary attitude is the boldness of the search and research, since it is the

transformation of insecurity into an exercise of thinking, into an act of constructing. Accordingly, interdisciplinary practice gains 'body' in the interlocution and articulation of various subjects to observe "[...] understand and manage situations of accommodation, tension or explicit conflict among needs, human practices and natural dynamics" (Floriani, 2000, p. 100).

In terms of teaching, interdisciplinarity cannot be a "combination of contents, nor a combination of methods, much less the combination of subjects" (Fazenda, 1993, p. 64). It implies a new thinking and acting, in a posture that favors openness to an interactive experience mediated by diversified knowledge. It seeks to overcome the linearity of the school curriculum, reorganizing them, in order to overcome the tendency of a mere follow-up of the ready-made list by grade in the teaching of Mathematics, as well as other areas of knowledge, which has been marked by a dichotomy between the curriculum proposed for Basic Education and the initial training of teachers, thus constituting a challenge for educators.

It is in this sense that we seek to reflect on the new curricular practice, producing a new social environment in which the knowledge of Mathematics becomes part of new forms of interlocution, interpretation and action, valuing relationships with everyday life outside of school. Conversation and questioning sustained by the sharing of knowledge systematically enriched by new discourses, looks and voices, which enrich new forms of thought and action articulated in a transformative perspective of diversified cultures (Galiazzi et al, 2008, p. 39).

We assume a proposition that the Mathematics curriculum should permeate learning from invention, investigation and discoveries. Therefore, curricula aligned with the BNCC should emphasize: the exercise of intellectual curiosity, formulating, solving and creating technological solutions, the use of digital and mathematical languages to express and share information, experiences, the understanding, use and creation of digital technologies in a critical, meaningful, reflective and ethical way, the access and dissemination of information, thus producing knowledge, exercising protagonism and authorship in personal and collective life. These are constituent elements that will drive Brazilian Education (Brasil, 2018).

Methodological procedures

This is qualitative research with methodology based on elements of collaborative research. According to Desgagné (2001) and Ibiapina (2008), cited by R. L. Carvalho *et al*. (2016, p. 78), collaborative research is:

> Desgagné (2001) states that collaborative research investigates a certain object that is often proposed by the university researcher; however, it interests and motivates future teachers to reflect on teaching practice. For Ibiapina (2008), in the field of education, this research method is a production of scientific knowledge and professional development, through the activity of training and reflection.

We chose this type of research because it is an investigation approach in which researchers and participants promote constant conversations between theory and practice, resulting in a richer knowledge of the real context of the collaborators, with the purpose of improving the quality of education and promoting significant changes in teaching practice.

It is noteworthy to inform that this study is part of a more comprehensive research approved by the ethics committee, since we followed all ethical procedures. The study took place in the context of the University-School articulation, with researchers and the teacher of the REM-NE partner school as participants, defined by the availability to participate voluntarily. A first meeting was held with the teacher at the presentation of the research, and there was an invitation to participate and sign the Free and Informed Consent Form (FICF). She will be identified with a fictitious name (code), as a way of preserving her identity.

This teacher graduated in the Interdisciplinary Degree in Natural Sciences and Mathematics, as well as a specific Degree in Mathematics from the same Federal University of Cariri (UFCA, as per its Portuguese acronym) on the Campus of the Institute for the Training of Educators (IFE, as per its Portuguese acronym), and teaches Mathematics in the final years of Elementary School.

Data collection took place through questionnaires designed in the Google Forms tool, in order to analyze the teacher's knowledge about equity, interdisciplinarity and the pedagogical practice adopted by her for the teaching of Mathematics with interdisciplinary actions. The data supporting the results of this study will be made available by the corresponding authors, [E.F.S.; A.C.F.L.; R.L.C.], upon reasonable request.

From the speeches of the research participant, it became possible to discuss and reflect considering the statements about the themes of interdisciplinarity and equity, through the Foucault's discourse analysis. For the French philosopher Michel Foucault, discourse has different definitions, among them "we will call discourse a set of statements that are based on the same discursive formation" (Foucault, 2008, p.132). For Rosa Fischer (2001), the Foucault's theorization of discourse suggests to researchers a way of investigating not what is "behind" the texts and documents. Therefore, the concern is not what was meant by that, but to describe what are the conditions of existence of a given discourse (and its set of utterances),

taking into account the historical and sociocultural context in which the discourses were produced.

Interdisciplinarity beyond the "relationship" between areas of knowledge

In Brazil, several authors carry out research on interdisciplinarity, among them is Ivani Fazenda, who has become a reference by researching the following topics in the area of education: interdisciplinarity, research, curriculum, education and teacher training. The author reports that, historically, interdisciplinary studies have existed in Brazil since 1960, where it is seen as a link between subjects, combating normalizing disciplinary fragmentation, acting as a pedagogical proposal that helps teachers in their development in the classroom, thus contributing to a more meaningful and comprehensive learning. In this way, teachers need to find space within the contents to be taught to include interdisciplinarity and with which other subject can have this interaction that contemplates the students' interest.

Regarding the results obtained with the research, participant Ana Júlia answered seven questions about interdisciplinarity and its approach in the classroom. The first question was: What do you mean by an interdisciplinary approach? **Ana Júlia**: "*It is when two or more subjects relate to each other, in order to establish a relationship between them, passing through all areas of knowledge".* In view of this speech, a restriction to the content is denoted, in order to induce that, at some point, it will interact with another curricular component, and it is up to the teacher to perceive this relationship and introduce it in an interdisciplinary way with the object of knowledge of another subject.

In view of the above, it is understandable that interdisciplinarity is more than a "relationship" between subjects, because if we restrict it, we will be assigning the curriculum to merely a formatting of its curriculum. Nevertheless, Fazenda (2015, p. 93-94) reports that if interdisciplinarity is defined as "an attitude of boldness and search for knowledge, it is worth thinking about aspects that involve the culture of the place where teachers are trained, its Human aspect!". From this definition, the analysis of this approach can be expanded, allowing the emergence of "the possibility of making explicit its epistemological and praxeological spectrum. Only then, it becomes possible to talk about the teacher and his/her training and, consequently, with regard to the subjects and curricula" (Fazenda, 2015, p. 94). In view of this argument, it is notable that, if during his/her training process the teacher has access to interdisciplinarity, his/her insertion in his/her classes will become more practical and natural. In another text, the same author reports that, during professional training, the use of

interdisciplinarity requires the development of competencies that can be adapted to its use in different subjects (Fazenda, 2010).

When asked if her classes have an interdisciplinary approach and to exemplify, **Ana Júlia** said: *"Yes. Because it is important to interconnect the different areas of knowledge to provide students with a greater understanding of the given content, being a means of giving meaning to their learning"*. In her statement, it is notable that she did not describe how she works interdisciplinarity in some object of knowledge and also does not describe what content she could address, which makes her discourse convergent with that of Terradas, who, when performing a survey with Mathematics teachers, obtained as one of the results: "most teachers understand that interdisciplinarity is the involvement or integration of several subjects to work, together, the same theme" (Terradas, 2011, p. 112). It is noticed that the teachers also did not report how they work with interdisciplinarity in the classroom. Despite the age difference of the surveys, we noticed that the reports made by the participants of the two studies are still similar, but Ana Júlia had an interdisciplinary training in Natural Sciences and Mathematics, which could broaden her understanding of the theme.

Following the analysis, the questionnaire asked the following question with four alternatives: Mark the thematic units, according to the Brazilian National Common Curriculum Base, that you consider possible to work in an interdisciplinary way: a) Numbers; b) Algebra; c) Geometry; d) Quantities and Measures e) Probability and Statistics. She marked the *alternative* "and". These thematic units that the teacher selected are related and can be applied in several areas of knowledge, such as Mathematics and Natural Sciences, thus allowing the student a less limited learning and directing him/her to draw his/her own conclusions relating the content to the practices, since they are indispensable in his/her daily life outside and inside the school. In view of this, "the student may be able to understand that Mathematics is everywhere, that it permeates and will permeate daily life, throughout his/her life, whether inside or outside educational institutions" (Oliveira, Souza & Paixão, 2021, p.15).

Accordingly, managing to develop competencies present in the BNCC (Brasil, 2018), such as: development of skills, argumentation capacity, understanding of phenomena, classification of results, among others, becoming clearer in competency number 3, which explains:

> Understand the relationships between concepts and procedures in the different fields of Mathematics (Arithmetic, Algebra, Geometry, Statistics and Probability) and other areas of knowledge, feeling secure about one's own ability to construct and apply

> mathematical knowledge, developing self-esteem and perseverance in the search for solutions (BRASIL, 2018, p. 265).

In view of the above, it is possible to identify interdisciplinarity when it highlights the relationship between the contents related to Mathematics and when relating it to themes from other areas of knowledge. Interdisciplinarity is increasingly present in social daily life from the purchase of food, the dollar exchange rate, health, public safety and the relationship between them and their impact on society. Thus, at school, it could not be different. This leads us to corroborate with Fazenda (2012, p. 91), when the author says that this approach "is a natural and internal requirement of the sciences". Therefore, a teaching and learning process linked to interdisciplinarity provides significant training for teachers and students.

Throughout the questionnaire, there is the following question: Are social issues important in activities with interdisciplinary approaches? Why? The **Ana Júlia's** answer was as follows: *"Yes, because social issues bring important aspects that can be related to the educational context, being a means of establishing a relationship with the content seen in the classroom with the students' daily life to provide them with a greater understanding"*. In order to promote interdisciplinary education, guaranteeing integration between curricular components, there are challenges to overcome, such as the boundaries between subjects, contextualization and the common goal of all areas of knowledge. But, in order for it to be effective in schools, there is a need to integrate social, cultural and school knowledge.

For this reason, the BNCC (Brazil, 2018) emphasizes that social issues must be inserted in all areas of knowledge, with emphasis on cultural plurality, environment, ethics, health and sexual orientation, in order to promote education with equality, diversity and equity. It is interesting to underline that the BNCC (Brazil, 2018) seeks to make the student the protagonist of his/her learning. For Yared (2008, p. 164), "interdisciplinarity leads the student to be the protagonist of his/her own history", thus obtaining the "dreamed" autonomy while being able to improve his/her socio-emotional skills. The same author emphasizes that the student during and after this process will:

> Personalizing and humanizing it, in a relationship of interdependence with society, giving it, above all, the critical capacity in terms of confronting the dominant and, why not say, oppressive culture, through precise and responsible choices for its liberation and for the transformation of reality (Yared, 2008 p. 165).

Based on the above, the student becomes able to explore the same theme on different approaches and perspectives, being stimulated to develop critical thinking and creativity, thus distancing himself/herself from memorization, learning the content, analyzing and

synthesizing, discussing, including the sociocultural and applying the knowledge in his/her daily and academic practice in a responsible way.

After ascertaining her conceptions about concepts and their interdisciplinary practices, we tried to abstract, from the teacher, her opinion about the development of activities together with other teachers. For this, the following questions were asked: Do you consider it easy to develop an activity with an interdisciplinary approach alone? Why? Do you believe that it is possible to develop an activity with an interdisciplinary approach, with the interlocution of other teachers in the school setting? How? The **Ana Júlia's** answer to the first question was: *"No, because the more people, the better it is to develop an interdisciplinary work"*; and to the second, it was: *"Yes, because I believe that it is possible to come up with more ideas to develop an interdisciplinary work, so that they interconnect the different areas of knowledge from a certain content, always seeking to provide greater understanding to students"*.

By relating the two answers, we perceive that the teacher addresses the importance of reconnecting the faculty members to have a more effective interdisciplinary approach. Because when the school's pedagogical team is in constant conversation, it facilitates thinking and carrying out activities in different areas of knowledge, thus resulting in interdisciplinarity and more comprehensive learning.

Going against the **Ana Júlia's** speech, M. M. de Carvalho (2015) says that one of the biggest difficulties to insert interdisciplinarity in the curricular components is the sharing of knowledge and working in teams, as they are used to the traditionalist method of teaching where interdisciplinarity does not take place. The same author points out a way to combat this problem, which is through teacher training focused on interdisciplinarity, as is the case of the interviewed teacher who graduated in an Interdisciplinary course in Natural Sciences and Mathematics. In this way, inviting teachers to interact and align the contents of their curricular components with others, allowing themselves to leave their (disciplinary) comfort zones and (re)create interdisciplinary methodologies aimed at meeting the social, cultural and school demands that contemporaneity demands.

Educational equity: paths to a fair education

Education is fundamental to promote equity but, paradoxically, it often ends up segregating precisely those who face the greatest social inequalities. According to Gatti and De Menezes (2021), the panorama of school education in Brazil still presents many challenges, especially after the problems that took place in the coronavirus pandemic, despite some advances achieved through educational policies implemented in the last thirty years.

Therefore, there is a need to foster even more discussions and actions that value social justice and promote equity.

But, for this, there is a need to understand what the term equity means and defining it is not a simple task. In common sense, it is often associated with equality and justice. Nonetheless, as G. H.G. Silva (2016) points out, in Mathematics education, it is common to believe that leveling the students' knowledge, offering the same teaching opportunities and the same treatment, seems to be fair. However, in many situations, equality may not be enough.

In order to further investigate the topic in question, the participant of our research answered a form with eleven questions that consider her familiarity with equity and the aspects observed in her experience in the classroom. In this sense, we seek to understand her perception of the term "equity". For **Ana Júlia**, equity is related to: *"Equality for all, so that everyone has access to the same opportunities"*. This statement reflects an important ideal, but it also raises crucial questions when analyzed in light of the concept of equity. The act of offering the same opportunities to all does not take into account these pre-existing inequalities. Although equality, understood as offering the same opportunities to all, is an essential principle in just societies, there is a need to ensure that everyone achieves the same success or has the same conditions for full participation.

According to the Principles and Standards for School Mathematics that shows the characteristics of high-quality Mathematics Education and the power of these principles, as tools and guides for decision-making "equity does not mean that each student should receive an identical education, on the contrary, it requires reasonable and appropriate accommodation, whenever needed, in order to promote access to the acquisition of content for all students". (NCTM, 2008, p.12).

Continuing with the analysis of the questions asked to our participant, we sought to know if she identifies learning differences among the students in her classes and she answered *"yes"*, citing some examples, such as *"communication, the construction of learning, in the experiences they have, as well as in the resources available within the educational context"*. In addition, it was asked if she diversifies the teaching strategies she uses within the classroom. The **Ana Júlia's** answer was *"maybe/in some cases"*.

The participant **Ana Júlia** told us that: "*Whenever possible, I try to establish the same opportunities for all students, for example, I always try to have the active participation of students at the time of class, especially those who have some special need, so that they can feel inserted and have the same opportunities as others"*. These points are important because

they show us that the teacher is aware that there are aspects that differentiate students' learning, which is why it is essential to diversify her strategies, but she is not always able to do this.

According to Trzaskos (2023, p. 75):

> It is important to highlight that we find students with different characteristics, cultures, customs, affective and social experiences in a classroom. In view of this, it is up to the teacher to select the knowledge to be transmitted to students, in order to reach everyone, taking into account individual differences.

Reflecting on these points leads us to the understanding that the classroom is a space of plurality. Each student carries with him/her a universe of experiences, skills and needs, and the teacher's role goes beyond simply transmitting content. According to Chiovatto (2000), he/she needs to be a mediator, someone who welcomes this diversity and creates opportunities for everyone to develop fully. By recognizing individual differences, the teacher starts to see students not as homogeneous recipients of knowledge, but as active agents in the process of knowledge construction. When teaching is diverse, it opens doors to more meaningful learning.

The participant Ana Júlia reported that she is willing to review her pedagogical practice to seek to reduce social inequalities and believes that conversations about race, racism, gender, sexuality, religion, etc. should be made in Mathematics classes. These were some of the questions in the questionnaire, as we believe that it is important to reflect together on these sociocultural factors, in order to think about teaching strategies that address these discussions in Mathematics classes. D'Ambrosio (2001), a pioneer in studies on Ethnomathematics, developed research and reflections on the teaching of Mathematics, verifying cultural relationships that can be related and explored from mathematical concepts, expanding the limits of this science, through the inclusion of everyday practices in the school context.

When asked if the teaching of Mathematics proposed in schools values the informal knowledge brought by students, coming from their daily cultural and social experiences, **Ana Júlia** replied that: "*Yes, in some situations; however, it is still needed to open more spaces in the educational context for diversity, the difference in cultures and social aspects"*. The speech of the research participant is in line with what Brazilian educators like D'Ambrósio have been trying to accomplish throughout history, but much has yet to evolve. According to Santana and Castro (2022, p. 84):

> The difficulties in terms of achieving equity in Brazil can be more complex because they are less explored. This can be seen, for example, in the Brazilian National Common Curriculum Base (BNCC), a normative document for the construction of Brazilian curricula, which barely mentions or explains the importance of the search for equity (BRASIL, 2018). Regarding the difficulties in terms of achieving equity in Brazil, Gutierrez (2012) indicates the extension of the Brazilian territory, the little exploration of experiences and opportunities, in addition to highlighting the inequality of results obtained by rich and poor citizens, and also between whites and mixed-race students.

In addition to what was exposed in the studies by Santana and Castro (2022), we also believe that another important factor is related to teacher training. There is a great need for training focused on diversity and the recognition of knowledge from the different social and cultural experiences of students. This gap makes it difficult to create an inclusive and equitable learning environment. Studies carried out by Trzaskos (2023, p. 82) about the Teaching Work Plans (PTDs, as per its Portuguese acronym) of Mathematics teachers point out that:

> It was observed that traditional classes still prevail, where techniques of exposition and solvability of exercises predominate. Attention to students who have a lack of knowledge or special needs is not always present in the analyzed actions held by the teachers. Only 20% of the examined PTDs have specific strategies to recover this gap or minimize the difficulties of students with special needs, such as individualized care.

It is perceived that this reality is repeated in several schools; and, among the triggering factors, we can mention: “teacher training, adequate school infrastructure, a reasonable proportion of students per class and per teacher, in addition to a solid curriculum, are intrinsically related to quality education” (TRZASKOS, 2023, p. 75). These are recurrent anxieties in the different realities of Brazilian schools and end up directly impacting teaching practice and the effectiveness of strategies aimed at equity in the teaching-learning process.

Santana and Castro (2022, p. 84) argue that “developing equity goes through social justice”. The authors state that, consequently, that educational bodies, schools and teachers must pay attention to the inequalities triggered by the standardization of curricular structures, since access to opportunities, such as financial and structural resources, are differentiated, according to the reality of each location.

In this sense, we seek to understand if the teacher considers that social inequalities are reflected in the opportunities for learning Mathematics. **Ana Júlia** told us that: “*In my*

opinion, the school as a whole has always had difficulty in terms of inserting the plurality of cultural diversity and opportunities for all in the educational context. Also, schools become more comfortable with the standardization of cultures, based on a dominant cultural reference, not taking into account diversity, cultural appreciation and opportunity for all students". The criticism presented by the participant relates the tendency of schools to standardize cultures instead of welcoming and valuing diversity, which hinders the provision of fair and inclusive opportunities for all students.

Corroborating the reflection presented by the participant, Trzaskos (2023, p. 73) tells us that students bring with them experiences, values and forms of knowledge that often do not find space in the school environment, which remains structured to meet a homogeneous and dominant view of culture and knowledge. As a consequence, high rates of repetition and school dropout arise. These indicators reflect not a lack of capacity or interest on the part of students, but rather the failure of the school to create an inclusive environment that is responsive to the needs and characteristics of each student.

The studies presented here highlight the importance of rethinking the role of the school in terms of promoting an education that values cultural diversity and creates equitable conditions for the success of all students. This involves not only curricular changes, but also a conscious effort to make the school environment welcoming and representative of the different realities revealed by students.

Final considerations

In view of the above, it becomes explicit that, although interdisciplinarity is seen as an approach that aims at the interaction and articulation between the subjects that make up the areas of knowledge of the school curriculum, contributing to a more meaningful and comprehensive learning, it is not worked with depth, taking into account that the teacher participating in the research, even though she graduated from an Interdisciplinary course in Natural Sciences and Mathematics, she defines this approach as a relationship between the subjects and has difficulty in terms of specifying how she would work with teachers from other areas. This shows us that even teachers with so-called interdisciplinary training still face

challenges to put into practice what is seen at the university, which is why the difficulties permeate teachers of disciplinary and interdisciplinary courses.

In this sense, it is not enough for the teacher to have knowledge about interdisciplinarity, which is why methodological strategies are needed for the development and effectiveness of this approach. This highlights the need for a deepening of interdisciplinary studies and their contribution to the teaching-learning process. When this process is linked to interdisciplinarity, it provides significant training for teachers and students. It is also notorious that, for the teacher, there are Mathematics contents that are easier to work with the other areas, such as Probability and Statistics, as they permeate between the areas of knowledge and the student's daily life.

It should be emphasized that the investigative problem that sought to understand how a professional development process can contribute to overcoming inequalities in student learning, focusing on equity and different curricular realities, was answered in the context of conducting the research in the school in a collaborative way between the University and Basic Education, through conversation with the participating teacher, thus fostering conversation about the inequalities existing in her classes, as well as reflecting on the (re)organization of her methodological practices that can contribute to the promotion of equity.

The research carried out in this work showed that there are still many advances and challenges to be overcome for the effectiveness of equity in the teaching of Mathematics. The process involves several structural, curricular, training and postural factors in the face of diversity and adversity.

From the considerations of the participating teacher, we perceive that there is an awareness of the importance of reflecting more on these themes, while recognizing that it is not an easy task, especially when it comes to teaching during Mathematics classes. The first step, which is indispensable, requires that teachers be open to thinking and developing differentiated teaching strategies, so that they make it possible to cover as many students as possible. Thus, we can move forward in the search for the effectiveness of equity and interdisciplinarity in the school environment.

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