
ARTICLE

Anxiety, Self-Esteem, and Belonging: The Affective Dimensions of Mathematics Learning in Higher Education

Ansiedade, Autoestima e Pertencimento: As Dimensões Afetivas na Aprendizagem de Matemática no Ensino Superior

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Abstract

This article presents an excerpt from a master's research project developed in the Postgraduate Program in Science and Mathematics Education at the Federal University of Paraná. The aim was to understand the effects of affective dimensions (anxiety, self-efficacy beliefs, and sense of belonging) on mathematics learning in higher education. Based on focus groups with students in exact sciences and technology programs, the data were analyzed using French-oriented Discourse Analysis, as proposed by Orlandi (2020). The results indicate that self-efficacy beliefs are not formed in isolation, but are interconnected with previous experiences, how students perceive themselves in relation to their peers, and their sense of belonging in the academic environment. It was observed that the experience of anxiety is often associated with low self-esteem and a perception of dislocation in evaluative and institutional contexts. On the other hand, experiences of listening, acceptance, and support among peers favor retention and engagement with mathematical content. The data reinforce the importance of considering affectivity as a constitutive dimension of learning and suggest that pedagogical practices sensitive to subjective experiences can increase the possibilities of academic success.

Keywords: Affectivity. Mathematical anxiety. Self-efficacy beliefs. Sense of belonging. Higher education

Resumo

Este artigo apresenta um recorte de uma pesquisa de mestrado desenvolvida no Programa de Pós-Graduação em Educação em Ciências e em Matemática da Universidade Federal do Paraná, que tem como objetivo compreender os efeitos das dimensões afetivas (ansiedade, crenças de autoeficácia e sentimento de pertencimento) na aprendizagem da matemática no ensino superior. A partir da realização de grupos focais, com estudantes de cursos da área de exatas e tecnologia, obtivemos os dados que, posteriormente, analisamos com base na Análise do

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Discurso. Os resultados indicam que as crenças de autoeficácia não se constituem de maneira isolada, mas se articulam com experiências anteriores, com o modo como os estudantes se percebem em relação aos pares e com os sentidos de pertencimento ao espaço acadêmico. Observamos que a vivência de ansiedade está associada, frequentemente, à baixa autoestima e à percepção de deslocamento em contextos avaliativos e institucionais. Por outro lado, experiências de escuta, acolhimento e apoio entre pares favorecem a permanência e o engajamento com o conteúdo matemático. Os dados reforçam a importância de considerar a afetividade como dimensão constitutiva da aprendizagem, e sugerem que práticas pedagógicas sensíveis às experiências subjetivas podem ampliar as possibilidades de sucesso acadêmico.

Palavras-chave: Afetividade. Ansiedade matemática. Crenças de autoeficácia. Sentimento de pertencimento. Ensino Superior.

1 Introduction

Discussions on affectivity in Mathematics Education have advanced in recent decades, with emphasis on Basic Education research. Studies such as Alves (2014) provide empirical evidence that teachers recognize fear as a factor that may negatively affect mathematics learning. Similarly, Rocha (2016) and Nobre (2018) argue that affectivity is directly related to school and academic performance, meanwhile Marzagão (2021) highlights the importance of a supportive relationship between teachers and students so students feel comfortable in class. Despite these advances, there is still a lack of studies investigating the affective aspects involved in mathematics learning in higher education. Among the various dimensions of affectivity, key elements include anxiety, academic self-esteem, and sense of belonging, elements that directly influence engagement, student retention, and development (McLeod, 1992; Chacón, 2003; Dobarro; Britto, 2010).

In this scenario, a survey conducted as part of the master's research that underpins this article (Guergolet, 2025) sought to identify how this theme has been approached in the Brazilian post-graduation programs. A search conducted in the CAPES Theses and Dissertations Catalogue, covering the period from 2000 to 2022, with the keywords *mathematics affectivity*, *emotional mathematics*, *affectivity and emotional mathematics* and *affective dimension*, resulted in 11 papers that approached the affective relationships in mathematics teaching and learning. Most of these studies were produced henceforth 2018 and are concentrated in Basic Education, with only one study focusing on Higher Education. These data indicate that investigations about affectivity in university contexts remain limited.

Entrance in higher education represents a moment of transition full of academic requirements, institutional adaptation and redefining student's identity. In this context, the confrontation of mathematics content, often marked by school experiences previously negative, may mobilize emotions that make learning difficult. Authors like Pekrun, Frenzel and Goetz

(2007), Zan and Di Martino (2007), Di Martino and Zan (2010, 2011) aim that these emotions are not limited to momentary reactions, but shape beliefs and attitudes that influence the way the students position themselves before mathematics.

Recent studies, like by Geisler, Rolka e Rach (2023), indicate that the fall of mathematics self-concept during the first semester of the university course is associated with evasion, being the sense of belonging a mediator factor between negative emotional experiences and the stay decision. In this way, understanding how students live the affective dimensions in the mathematics learning process may contribute for the development of pedagogical practices more sensitive to student's experience.

This article presents an approach of a master's research carried in Post Graduation Program in Education in Science and in Mathematics (PPGECM) based at Federal University of Paraná (UFPR), which main objective was to comprehend how affective relations influence the teaching and learning processes in subjects from Mathematics Department. Specifically in this context, we analyze the effects of anxiety, of self-efficacy beliefs and the senses of belonging in the learning of mathematics in higher education, henceforth the feelings produced in the discourses of students who have participated in focal groups.

2 Initial considerations: the affectivity and the mathematics learning

The studies related to Affectivity have gained a bigger space in the area of Mathematics Education. Even in a timid way, it appears that it has a bigger concentration of works about affectivity in Basic Education than in Higher Education. We define the Affective Dimension (Ad), such as Chacón (2003), as:

An extensive category of feeling and humor (mood changes) that generally are considered as something different from pure cognition. In our definition we consider not only feelings and emotions as basic descriptors, but also, beliefs, attitudes, the values and considerations. (Chacón, 2003, p. 20).

The author claims that such components not just coexist with the reason but contemplate in the constitutions of educational experience.

In the field of Mathematical Education, the studies of McLeod (1989, 1992) also highlight the importance of the affect, dividing in the main components: emotions (short-term responses), beliefs (visions relatively unstable that influence behavior) and attitudes (tendency of actions based on previous experiences). These elements form a complex system that directly affects the way students engage themselves with mathematical content. McLeod (1992) still emphasizes that repeated negative emotional experiences may modify and consolidate

unfavorable beliefs that these students would have about themselves and about mathematics, affecting their academic performance.

Among the affective components, mathematical anxiety stands out as a frequent phenomenon. According to Pekrun, Frenzel e Goetz (2007), emotions like anxiety and fear, associated with the context of academic achievement, interfere in motivational aspects, in self-regulation and in cognitive processes evolved in learning. The authors still claim that "the emotions influence the cognitive processes, the motivation, the use of self-regulation strategies versus external regulations of learning" (Pekrun; Frenzel; Goetz, 2007, p. 16).

The academic self-esteem and the beliefs of self-efficacy also appear as widely elements studied in research about affectivity and mathematical learning. For Dobarro and Britto (2010), the belief of self-efficacy refers to conviction of the subject regarding their capacity to do determined tasks, and this belief exercises strong influence on the behavior, the motivation and this subject's school performance. The low self-efficacy is often associated with evasion, discouragement and difficulty in facing academic challenges.

The attitudes regarding mathematics, on one hand, evolve affective, cognitive and behavior components, according to what is proposed by Zan and Di Martino (2007) and Di Martino and Zan (2010, 2011) in the model of *Three-dimensional Model for Attitude* (TMA). According to the authors, mathematical attitude is composed of three dimensions: the emotional willingness before the subject, the perceptions of competency and the mathematics view as a know-how. This model seeks to overcome the positive/negative dichotomy traditionally attributed to attitudes, proposing a more integrated approach.

Beyond the individual subjective dimensions, institutional and sociocultural aspects also influence the building of affective experiences in learning. Vygotsky (2007) highlights that cognitive development occurs in contexts mediated by social interactions. and that emotion and cognition are inseparable in the process of internalizing knowledge. In this way, the Zone of Proximal Development (ZPD) is not limited to cognitive support but also evolves emotional and affective support that allows students to advance in their learning process.

Pedagogical practices play a fundamental role in the mediation of affective dimensions. As stated by Leite (2012), all of the decisions made by teachers (since the content choice, ways of organizing the classes and assessment procedures) carry affective implications, which may approach or move away students from the content and from the learning environment. The author highlights the sensitive practices to affectivity contribute to strengthen positive connections between the subject and object of knowledge and promote academic residence.

Contemporary studies have reinforced the centrality of affectivity in the context of

learning university mathematics, especially in the moment of transition for higher education. Geisler, Rolka e Rach (2023), when investigating arrival students in mathematics courses, identifies that the decline in the interest and in the mathematical self-concept during the first semester is significantly associated with academic evasion. The authors prove that negative affective changes, especially in relation to self-perception of competency, have direct impact on student's retention in university.

These finding dialogue with the control-value theory of academic emotions (Pekrun; Frenzel; Goetz, 2007), accordingly anxiety and other emotions of accomplishments influence not just the development, but also self-regulation, the engagement and the motivation to learn. Complementarity, studies indicate that the sense of belonging acts as a mediator between the negative emotions and the evolving of mathematics, suggesting that warm academic environments may mitigate the effects of anxiety and favour beliefs more positive of self-efficacy (Schoenherr; Schukajlow; Pekrun, 2025). Thus, recent literature confirms the effects like anxiety, self-esteem and belonging are not peripheral factors, but constitutive of the experience of learning in subjects traditionally challenging like mathematics.

3 Method

This study inserts itself in a qualitative approach, with the objective of analysing the effects of anxiety, of self-esteem and of belonging in university student's learning in subjects of mathematics. The research is associated with a wider project developed in PPGECEM, approved by the Ethics Committee in Research with Human Beings (CEP/CHS-UFPR), under review number 6.415.496 and CAAE no 72954423.0.0000.0214.

The production of data occurred through two focal groups, composed of students regularly enrolled in subjects from the Mathematics Departments of UFPR, derived from the courses of Mathematics and Computer Science. The technique chosen to favor collective listening and allow the sharing of affective experiences was peer dialogue (Gatti, 2005). Each group has two meetings made remotely through the platform *Microsoft Teams*, with one hour to one hour and a half of last. There were five students in Group 1 from Computer Science (three men and two women) and Group 2, initially with five students from Mathematics (three women and two men), it ended with the participation of three women due to the refusal of a member before the beginning and the refusal of another one in the second meeting. The criteria of selection aimed at ensuring gender diversity, course and academic trajectory, providing plurality in the mixture of the groups. The participation was voluntary and conditioned to the

signature of the Informed Consent Form. In general, participants demonstrated commitment and engagement to the proposal.

The meetings were guided by semi-structured script with keywords and open questions, allowing participants to report their experiences, emotions and perceptions in relation to learning of mathematics in higher education. The mediation was conducted in a way to ensure the focus of the discussion and promote an environment of listening and respect among the participants.

In the data analysis it was inspired in the perspective of Discourse Analysis of French orientation, in accordance with Eni Orlandi (2020). This approach considers the discourses as practices intersected by ideological formations, subject-positions and specific contexts of production. Although the references of Discourse Analysis have oriented the analytical view, its application in this research was adapted to the scope of the study, prioritizing the listening of regularities and discursive dislocations, understood, in Orlandi's perspective, as shifts of meaning that occur when a statement, when circulating, is intersected by other discourses and starts to mean in a different way due to the conditions of production and the place where it is said, available in participant's speech.

The analytical *corpus* was built from the identifications of statements that approached, in a recurrent way, aspects related to anxiety, self-esteem and belonging. It was selected excerpts that expressed these senses directly, as well as the researcher's observations about long pauses, hesitations, alterations in the tone of voice or silences during the meetings. These elements were considered relevant evidence for the comprehension of meanings of effects available in discourses.

The analysis evolved the integral transcription of the meetings, fluctuating reading, identification of linguistic patterns, metaphors and other figures of speech, besides the observations of processes of subjectivation and ideological formations related to university experience. As detailed by Orlandi (2020, p. 57), the process of analysis implies considering "what was said in relation to what was not said, what the subject says instead of what is said in other place", as well as the social contexts and institutional that shape the meanings and subject's positioning.

Finally, the data were analyzed under the light of literature about affectivity in the perspective of Chacón (2003, 2011) and Mecleod (1992) and mathematics learning, aiming to comprehend how the affective dimensions mobilized in student's discourse are articulated to the academical challenges lived in the subjects of de Mathematics Department. This methodological approach allowed us to prove aspects of a teacher's experience, without claim

of generalization, but with the commitment of understanding deeply the meanings produced in the specific context.

4 Analysis and Discussion

This section presents the data analysis produced in the ambit of mater research developed along with PPGECEM. For this article, we made a specific clipping of this investigation, centered in two thematic nuclei built from the analysis of the focal groups: *Anxiety and Academical Self-Esteem and Sense of Belonging*.

This work analyses the effects of these affective dimensions (anxiety, self-esteem and belonging) in mathematics learning in higher education, from the meanings produced in participant student's discourses, privileging the listening of the effects of meaning that emerge from subject-positions, of the conditions of production and of the ways participants insert themselves in the academic space.

The building of the thematic nuclei was based on the recurrence of terms, expressions and meanings shared in the discourses, as well as in the observations of the researcher about silences, tensions or hesitations relevant in the affectivity fields. Although the cores are presented separately for analytical endings, the reading of the data reveals interconnections among them, which will be explored in the third part of this section. The articulation with the theoretical framework aims to evidence the comprehension of these meanings under the light of literature about affectivity, academic anxiety, beliefs of self-efficacy and belonging in mathematics teaching.

4.1 Anxiety and academic self-esteem in the context of mathematics learning

The participants' student's speech reveals that academic anxiety and low self-esteem are not peripheral factors but structuring of learning experience in the subjects of mathematics. These elements appear associated with the experiences of assessments, the public exposition to failure and to the development of low beliefs of self-efficacy. This is what we may observe from some excerpts transcribed from focal groups:

Student M3: Anxiety stops me learning correctly; I feel that I'm never ready for the tests.

Student M2: Even when I study a lot, I get anxious and this paralyzes me during the tests (Research data, 2024).

These assertions exemplify how anxiety acts as a paralyzing force, which may be

associated with mathematical anxiety as described by McLeod (1992), which would be a negative emotional reaction before the need to use tools or mathematical concepts. Mathematical anxiety may be difficult in mathematical problems resolution in different levels, once that triggers negative emotions with different intensity, affecting cognitive aspects and bringing physiological reactions, triggered by emotions of high intensity.

The discursive recurrences of terms like *fear*, *paralysis*, *not being ready* and *basic errors* indicate effects of sense associated with a model of assessment of classification, that ranks the student as someone always in deficit. As highlights the discourse analysis proposed by Orlandi (2020), what is not said (the silences, the hesitations and the meaning displacements) also produces meanings. In this case, the lack of references to experiences of overcoming or reception in evaluative contexts reinforces the settings of a subject marked by insecurity.

The relation between anxiety and self-esteem is complex, but consistent with the theory of *control-value* of academic emotions (Pekrun; Frenzel; Goetz, 2007), that points to the feeling of control about tasks and the score attributed to them modulate anxiety directly. When the student does not realize they are able to do the proposed activity, or when the assessment takes an out of proportion score in the course's structure, the anxiety intensifies and compromises the engagement. It is confirmed in the report that follows:

Student C2: Failing a subject has traumatized me to the point of developing panic crises before tests (Research data, 2024).

The concept of self-efficacy belief, discussed by Dobarro and Britto (2010), also reveals itself essential to understand the students' speeches. The perception of being able to deal with academic challenges makes one of the main predictors of performance, being influenced by previous experiences of success or failure.

Student M2: I never feel ready, even when I study a lot (Research data, 2024).

This signals a belief of low self-efficacy, which affects their motivation and willingness to learn.

In regarding, recent studies as from Geisler, Rolka and Rach (2023) evidence the fall of mathematical self-concept during the first semester of higher education which is directly associated to the risk of evasion, corroborating the importance of self-concept in academic journey that also is analyzed from an affective perspective, considering the success and failure for beyond the purely meta cognitive abilities.

4.2 Sense of belonging as factor of retention and academic engagement

The discourses of students evidence that the sense of belonging composes a relevant dimension of learning experience in mathematics subjects. The presence of assertions that express displacement, invisibility or inadequacy suggest that symbolic distancing may occur through impersonal pedagogical practices, limited interactions or implicit comparisons.

Student C2: I feel that I am always late than the others; it is difficult to develop a sense of belonging, because even when everybody is late it seems that I am more than them (Research data, 2024).

This assertion points to the perception of peer asymmetry and its implication in academic identity building.

The discourse analysis, as proposed by Orlandi (2020), allows us to understand that such assertions mustn't be interpreted as individual manifestations of insecurity, but as effects of subject-positions made by discursive formations that associate belonging to visibility and to academic performance. The lack of references in pedagogical practices that recognize students in their singularity contributes to the production of senses linked to symbolic exclusion.

Other assertions, however, indicate possibilities of rupture with this scenario.

Student C4: Having colleagues share experiences helps a lot, especially in moments of difficulty (Research data, 2024).

This speech suggests that belonging may be favored by horizontal interactions among students. This perspective is also present in the report of C5.

Student C5: When you realize that you are not the only one with issues, the sense of belonging helps to continue (Research data, 2024).

In the context of master's research, Vygotsky (2007) was mobilized to understand the social dimension of learning and the processes of mediation. The authors affirm that an individual's behavior is formed in the process of their social life, which allows us to understand that interpersonal relations make space for relations building. This comprehension contributes to understanding how students, when sharing academic experiences with their peers, develop ways of identification that rebound in the sense of belonging.

Besides, Guergolet *et al.* (2025, p. 77) states that the development of a good communication among professors and students may "bring a sense of belonging and, many times, a proximity among them, what also accommodate in an environment that, in a positive way, influence in the student's learning", claim corroborated by C1's speech:

Student C1: Being in a warm environment makes it all different for me to feel that I belong to that place (Research data, 2024).

The data analyzed suggest that belonging may act as mediator among the difficulties lived and academic residence. In the moments where there is listening and sharing among peers,

students demonstrate a higher engagement in the proposed activities. The lack of these elements tends to favor the distancing and the sense of inadequacy before mathematics in higher education.

4.3 Articulation among thematic nuclei: affectivity and belonging in mathematics learning

The data analysis indicates that the thematic nuclei, *anxiety and academic self-esteem and sense of belonging* do not present themselves in an isolated way in student's experiences, but interlace themselves in university experience. The recurrence of terms like *fear, isolation, I cannot follow* or *I do not feel that I belong to it* evidence that the feelings of anxiety and low self-esteem many times coexist with a fragile sense of belonging to the course, to the group and to the institutional space.

In this context, it was possible to observe that academic anxiety expressed by students is not untied of ways how they perceive themselves included or excluded in the learning process. The reports suggest that the perception of not belonging intensifies the insecurities and feeds inefficacy beliefs. On the other hand, students report experiences of support among peers or warm pedagogical practices tend to report bigger confidence in their abilities and less impact of anxiety in their performance.

This articulation between belonging and self-efficacy belief finds support in literature. According to Vygotsky (2007), the behavior and the development of individuals constitute themselves in the context of social interactions. This means that feelings like insecurity, competence and motivation are not attributes purely individual, but they are mediated by the quality of relations made in the learning environment. In this way, practices that favor listening, collaboration and the recognition in student's trajectory may act as mediators between the negative emotions and academic residence.

Additionally, studies by Geisler, Rolka and Rach (2023) and by Guergolet *et al.* (2025) evidence that an environment that promotes dialogues and reception reduces the effects of anxiety and contributes to strengthening self-esteem and of sense of belonging. These aspects, in turn, influence motivation, engagement and the disposition to face challenges in the mathematics learning process. These data are also corroborated by studies of Chacón (2011), that verified, from a questionnaire with students, that the students with beliefs more positive about themselves tend to present better indicators of academic performance.

Therefore, the data points that affectivity and belonging are not accessory aspects, but constituents in the relation that students establish with the mathematical knowledge. The lack

of pedagogical strategies sensitive to these dimensions contributes to the maintaining of inappropriate feelings, meanwhile their presence may favor the redefinition of experiences of learning and expand the residence possibilities and academic success.

5 Final Considerations

This article presents a cut-off of the master's research that sought to comprehend how affective relations influence the teaching and learning processes in subjects of Mathematics Department from UFPR. More specifically for this article, our objective was to analyze the effects of affective dimensions — anxiety, self-efficacy beliefs and sense of belonging — in mathematics learning in higher education. From the analysis of the discourses made in the focal groups, it was possible to identify how these affective dimensions are articulated in the building of student's academic experiences, influencing in the way they engage with the contents and with the university environment.

The discourses analyzed evidence that self-efficacy beliefs developed by participants' students, in other words, the perception of being able to face the academic challenges are not built in an isolated way. They are associated with as much the previous experiences of success or failures as the way subjects realize themselves in relation to their colleagues, the professors and the institution. In a lot of moments, student's speech evidence a sense of not belonging, that also is realized as discomfort during the meetings of the group to report situations that could be understood/read/interpreted by the other participants as academic failure.

The apparent displacement that some individuals report contributes to the weakening of the belief in their own ability, which, in turn, rebounds the academic development. The relation between self-efficacy beliefs and the sense of belonging indicates that mathematics learning cannot be understood just like a technical or individual process.

Such observations dialogue with the findings of Guergolet *et al.* (2025), that evidence how communication among professors and students contributes to the sense of belonging and for the approximation between them. This process, when fortifying the interpersonal relations in the academic context, simultaneously influences cognitive and affective dimensions in learning, rebounding in the engagement and the residence of students.

The articulation among data and theoretical framework supports self-efficacy beliefs, according to what is defined by Dobarro and Britto (2010), it constitutes a conviction of the subject regarding the ability of doing a determined task. Such conviction is built over the school and academic experiences, being shaped by repeated experiences of success or failure, and

modulated by social interactions that permeate the formative path. In the case of the students analyzed, self-efficacy belief appears weakened when associated with evaluative environments realized as threatened, due to the lack of warm pedagogical practices and the sense of invisibility in the university space.

In this way, the sense of belonging takes a mediator role between the negative effects and the motivation for learning. The analysis evidenced that students that experiment horizontal interactions with colleagues, and that they feel heard and recognized by their professors, tend to relate to a bigger willingness to face the academic challenges. In consonance with the vygotskian perspective, the data indicates that the interaction besides favoring cognitive development, also evolves affective dimensions, since, in this exchange space, the students build meanings about themselves, about the mathematics and about their places in the university.

Still based on Chacón (2003), it is possible to affirm that the mathematics learning evolves affective components that, when disregarded, difficult the building of stable bonds with knowledge. The author highlights that beliefs, emotions and attitudes make an interdependent system that manifests in the actions of students before the subject. This way, reiterated experiences of insecurity, fear or isolation may contribute to the strengthening of negative beliefs and for the distancing of mathematics as a knowledge field. On the other hand, experiences guided on reception, empathy and listening enable the redefinition of previous school experiences and favor the building of a new link with the content.

In this context, pedagogical practices appear as one of the spaces in which these affective relations come to materialize. The analysis of the master's research indicates that the pedagogical practices are directly related to the affective dimensions of learning. The student's reports presented that factors like the organization of teacher's work, the empathy in interactions and the way of conducting assessments influence the experiences of learning. Marzagão (2021) highlights that

The action of planning a class considering student's specificities, in ways of teaching the contents in a way that students get interested and like to study, mainly mathematics, it is an attitude manifested by professors as important in the establishment of a good relationship with their students (Marzagão, 2021, p.99).

Besides,

[...] the student needs to be seen and understood beyond their cognitive aspects. It must be understood as an individual that has the right to learning, that has feelings, that thinks and has attitudes permeated by emotions and not just the reason (Marzagão, 2021, p. 94).

This perspective articulated itself with the notes of Leite (2012), accordingly the

pedagogical decisions related to the organization of classes, to the promotion of collaborative interactions and to the adoption of diagnostics and formative assessments may contribute for the reduction of anxiety and strengthening self-efficacy beliefs. In this way, pedagogical practices are set as one of the elements that compose the relation between the affectivity and the learning of mathematics in Higher Education.

The results presented suggest that mathematics teaching in higher education needs to recognize the affective dimension as constitutive in the learning process. Ignoring the subjective experiences of students is, many times, to reinforce a logic that associates academic success with emotional coldness and to intellectual isolation. Including effectiveness in the pedagogical practice, in turn, does not mean neglecting academic integrity, but increases the possibilities of participation, residence and the student's development in academic spaces.

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Authorship contributions

All the authors have contributed, substantially, in the conception and the study planning; in the acquisition, analysis and data interpretation; in the essay and critical review; and approved the final version to be published.

Data availability

The data generated or analyzed during this study may be provided through request, since it respects the confidentiality of the participants and keeps the ethical warranty established in the Informed Consent Form (ICF) signed by participants in the focal groups.

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Annexes

Annex 1 - ICF (INFORMED CONSENT FORM)

INFORMED CONSENT FORM

Project's Title: **The Affectivity in Relations of Teaching and Learning: Its Importance in Arrival Student's Learning in the Subjects of DMAT-UFPR**

Responsible researcher: **Elisangela de Campos**

Assistant researcher: **Beatriz Borba Guergolet**

Place of Research: **Federal University of Paraná, Polytechnic Center Campus - (online)**

Address: **Av. Ph. Francisco H. dos Santos, 100 - Jardim das Américas, Curitiba - PR, 81530-000.**

You are invited to participate in research. This document, called "Informed Consent Form", aims to ensure your rights as a research participant. Please, read with attention and quietly, enjoying asking any questions. If there are any questions before or after signing it, you may search for orientation with the researcher's team. You are free to decide to participate and may withdraw any time, without being harmed in any way.

The research entitled The Affectivity in Relations of Teaching and Learning: Its Importance in Student Arrival's Learning in the Subjects of DMAT-UFPR, has the objective to understand the impact of Affective Relations in Student's Learning in Higher Education, of arrival students in the subjects from the Mathematics Department of UFPR.

Participating in the study you are being invited to:

- i. Participating in a focal group that aims to discuss the impacts of Affective Relations in the learning process of students from Higher Education that are arrivals in the subjects from DMAT-UFPR.
- ii. For the data formation, you will participate in a focal group that will work in the following way: participants will have a theme for each meeting, and will discuss their perceptions, worries, and reflections regarding the theme, that will evolve affectivity in teaching-learning of mathematics. The group meetings are going to be recorded, in audio and video, by the cameras available by UFPR, and in the future will be analysed considering Discourse analysis.
- iii. The total time spent by participants will be around 3 hours, split in 2 meetings of 1 hour to 1 hour and a half, the meetings will be weekly, with calendar stipulated according to the time available by participants.

Discomfort and risks:

i) **Discomfort and risks:** because it treats a thematic of Affectivity, we can point how possible risks to emotions when speaking about your experiences, perceptions and reflections, which may cause some discomfort;

ii) **Protective measures:** In order to minimize the risks the researcher will do active listening in the meetings, in case the participant is taken by their emotions, good or bad, that make them feel overloaded, we propose an individual talk with the participant in order to calm them down and understand them, besides we assure the liberty to the participant of leaving the meeting earlier, or not to participate in the research anymore.

iii) **Benefits:** The meetings are shown as an opportunity to reflect about your conceptions, worries and reflections about the mathematics affectivity, in this way we may mention as benefits to the reflections around the importance of the affective relations in the processes of teaching-learning and a deep reflection about your conceptions regarding the theme.

The data obtained for this study are being used uniquely for this research and stored for the period of five years after this research ending, under responsibility of the responsible (s) researcher (s) (Res. 466/2012 and 510/2016).

Data storage way: The data will be stored digitally in two clouds: Google Drive and OneDrive.

Confidentiality and privacy: You have the warranty of confidentiality preservation and of your privacy during all the phases of the research, except when having your explicit manifestation in the reverse way. In other words, your name will never be cited, unless you manifest that you give up the right of confidentiality.

() I allow the image recording, voice sound and/or testimonials uniquely for this research and I am aware the data guard are from the responsibility of the researcher (s), that are compromised to keep the confidentiality and the privacy of data.

() I do not allow image recording, voice sound and/or testimonials for this research.

Recovery and Indemnification: The research will be made remotely in a way that there will not be recovery of participant's displacement.

Before eventual expense, you will be recovered by the researcher (s). You will be warranted to the right before eventual damage resulting from the research.

Research results: You will be warranted access to the results of this research. After the data formation results from the meetings, the same will be analysed from the Discourse Analysis perspective. After the writing of the results and the discussions the same will be sent to every participant by e-mail, aiming at the reports about writing representativeness.

Contact:

In case of any doubts about this research, you may get in touch with the researcher (s):

Responsible researcher: Elisangela de Campos

Assistant researcher: Beatriz Borba Guergolet

Address: Mathematics Department, Polytechnic Center, Exact Sciences Building I - 3rd floor.

Email: eliscamposmat@gmail.com and beatrizguergolet@gmail.com

In case of reports or complains about your participation and about ethic regards of the study, you may get in touch with the secretary of Research Ethics Committee for Human and Social Sciences of the Human Sciences Sector (REC/HSS) of the Federal University of Paraná, General Carneiro Street, 460 - Building D. Pedro I – 11º floor, room 1121, Curitiba – Paraná, Telephone: (41) 3360 – 5094 or by email cep_chs@ufpr.br.

The Research Ethics Committee (REC): The role of REC is to evaluate and accompany the ethics aspects of all the researches evolving human beings. The National Research Ethics Commission (NREC) has an objective to develop the regulation over the protection of the human beings evolved in research. It performs a coordinator role of the network of Research Ethics Committees (RECs) of the institutions, besides taking the function of an advisory body in the area of ethics in research.

You have the right to access this document always you need to guarantee your right of access to the ICF, this document is drawn in two copies, signed and countersigned by the researcher (s) and by the participant/legal guardian, being one copy to be with you and the other with the researcher.

This research was submitted to the Research Ethic Committee with human beings from the UFPR under the number CAAE n° 72954423.0.0000.0214 and approved with Report number 6.415.496 emitted in 09 of October 2023

Informed Consent Form:

After reading this document with the information about this research and not having any doubts, I inform you that I accept to participate.

Name of research's participant:

(Research participant's signature or name and signature of your LEGAL GUARDIAN)

Date: ____/____/____.

Annex 2 - SEMISTRUCTURED QUESTIONS SCRIPT FOR THE FOCAL GROUPS MEETINGS

MEETING	QUESTIONS
First Meeting	1 - How do you characterize your relationship with mathematics? 2 - What are the main factors that influence your emotions in relation to the subjects of mathematics? 3 - How dealing with challenges and frustrations in subjects of mathematics affects your self-esteem and trust in your abilities? Do you have any specific strategies to deal with these feelings? 4 - How the emotional experiences in mathematics subjects influence your perception of your own identity how university student? This may include senses of belonging or exclusion in the academic environment.
Second Meeting	5 - How does the way professors approach the teaching of mathematics affect your emotional experiences? Have you already had positive or negative experiences with professors that adopted different teaching styles? 6 - In what emotional support from classroom colleagues or professors' impact in your motivation and academic development in mathematics subjects? Have you already benefited from the emotional support of other people during your studies? 7 - Did you already have positive experiences of emotional connection with the content of mathematics or with the resolution of challenging issues? How did these experiences affect your relation with discipline? 8 - What role does emotional self-expression perform in your mathematics learning? Do you feel comfortable sharing your doubts, worries and successes with others? 9 - In what way does emotional support from the classroom colleagues or the professors impact your motivation of academic performance in mathematics subjects? Have you already benefited from the emotional support of other people during your studies?