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Formative pathways for financial mathematics education in the education of Indigenous teachers

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ABSTRACT

Background: Initial Indigenous teacher education requires articulating traditional knowings and school knowledge, and critical financial mathematics education (FME) remains little explored in this context. **Objectives:** To understand how Indigenous knowings and doings are mobilised and re-signified alongside FME concepts during the formative process of Indigenous teachers, and to examine the impacts of a contextualised didactic-methodological approach on FME learning in intercultural teacher education. **Design:** Qualitative research of ethnographic inspiration, carried out during a Teaching Practicum in the FME subject. **Setting and Participants:** Indigenous Teacher Education Degree programme at the School of Education at the Federal University of Amazonas, Manaus campus, with six Indigenous students from different ethnic groups who authorised the use of their information. **Data collection and analysis:** Data were produced through Formative Trajectories, autobiographical texts written by the students, and analysed through their educational narratives. **Results:** Practices such as handicrafts, natural resource management, and community economic organisation served as contexts for teaching financial topics; students developed the concept of cost-time and re-signified mathematical-financial concepts based on their own knowings. **Conclusions:** Linking traditional knowings and FME concepts expands the pedagogical and epistemic possibilities of Indigenous teacher education, and knowledge comes to be understood as a collective, accessible and transformative good committed to fairer and more sustainable societies.

Keywords: Financial mathematics education; Ethnomathematics; Indigenous knowledge; initial Indigenous teacher education.

Itinerários formativos da Educação Matemática Financeira na Formação de Professores Indígenas

RESUMO

Contexto: A formação inicial de professores indígenas exige a articulação entre saberes tradicionais e conhecimentos escolares, e a educação matemática financeira (EMF), sob uma perspectiva crítica, é um campo ainda pouco explorado nesse contexto. **Objetivos:** Compreender de que modo os saberes e fazeres indígenas

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são mobilizados e ressignificados em meio aos conhecimentos da EMF durante o processo formativo de professores indígenas, e verificar os impactos de uma abordagem didático-metodológica contextualizada sobre a aprendizagem da EMF na formação docente intercultural. **Design:** Pesquisa qualitativa de inspiração etnográfica, desenvolvida durante o Estágio em Docência na disciplina de EMF. **Ambiente e participantes:** Curso de Licenciatura em Formação de Professores Indígenas da Faculdade de Educação da Universidade Federal do Amazonas, campus Manaus, com seis estudantes indígenas de diferentes etnias, que autorizaram o uso de suas informações. **Coleta e análise de dados:** As informações foram produzidas por meio de percursos formativos e de escritos autobiográficos elaborados pelos estudantes, analisados a partir das narrativas de formação. **Resultados:** Práticas como o artesanato, o manejo de recursos naturais e as formas de organização econômica das comunidades funcionaram como contextos para o ensino de temas financeiros; os estudantes elaboraram o conceito de custo-tempo e ressignificaram objetos do conhecimento matemático-financeiro a partir de seus saberes. **Conclusões:** A articulação entre saberes tradicionais e conhecimentos da EMF amplia as possibilidades pedagógicas e epistêmicas da formação de professores indígenas, e o conhecimento passa a ser compreendido como bem coletivo, acessível e transformador, comprometido com sociedades mais justas e sustentáveis.

Palavras-chave: Educação Matemática Financeira; Etnomatemática; saberes indígenas; formação inicial de professores indígenas.

COMING UP WITH THE IDEA OF A PATHWAY

Just as in a pathway that is characterised by a detailed route plan, a travel itinerary, or a journey, defining roadways, stops, schedules, and destinations to be followed, we were inspired to approach this article, which investigates the interactions between traditional Indigenous knowings and a didactic-methodological approach carried out in the formative spaces of the Indigenous Teacher Education (Formação de Professores Indígenas — FPI) degree course of the School of Education (FACED) at the Federal University of Amazonas (UFAM), Manaus/AM campus, during the Teaching Practicum. The course specifically serves Indigenous individuals from several ethnic groups in the Lower Amazon Basin and aims to train Indigenous teachers from a critical, interdisciplinary, intercultural perspective committed to strengthening the culture and language of their peoples (Federal University of Amazonas [UFAM], 2023).

The elements that make up our research emerge from formative practices with financial mathematics education (FME) based on the concrete realities of Indigenous communities as reflected in the experiences of

prospective[1] Indigenous teachers, with the premise being the dialogue between these experiences and FME knowledge from a "[...] critical, interdisciplinary intercultural perspective focused on cultural and linguistic strengthening, Indigenous teachers [...]" (UFAM, 2023, p. 25). In this regard, the formative activity incorporated elements such as crafts, natural resources management, and other traditional forms of production and social organisation as learning tools derived from the FME.

In view of the above, this study,[2] carried out during the Teaching Practicum in the FME subject of the FPI/Faced/UFAM course, is also one of the outcomes of our thesis research from the Postgraduate Programme in Education (PPGE)/Faced/UFAM. It also stems from the reflections and understandings developed within a mathematics education study and research group that is premised on collaboration among teacher educators, researchers, and students, linking teaching, research, and outreach. In its activities, this collective has emphasised investigative practices that view the classroom as a space for knowledge production and value the sharing of Indigenous knowings between teachers and students, a perspective that inspires the educational proposal analysed here.

In this way, the collaboration of the course teachers, the Indigenous pre-service teachers (PSTs) and the guest researchers involved in this formative process fostered a connection between theory and practice, creating a learning space that strengthened the education of pre-service Indigenous teachers and contributed to the development of teaching that is contextualised within the sociocultural practices brought by these students and the knowledge of the FME.

In this regard, this study is part of a formative experience anchored in methodology, research, and teaching based on critical financial education situated in an Amazonian Indigenous context of inclusion and diversity, guided by the field of Indigenous school education, with a specific focus on the initial education of teachers with the theme of sociocultural diversity, whose central question was: How are Indigenous knowings and doings mobilised and given

[1] We would like to highlight that some of them already work as teachers in their villages.

[2] For this, we would like to thank the Federal University of Amazonas; the Coordination for the Improvement of Higher Education Personnel; the Amazonas State Research Support Foundation; and the State Secretariat for Education and School Sport for their support and encouragement.

new meaning in the context of FME knowledge during the formative process of Indigenous teachers? To answer this question, we aim to assess the impact of a contextualised didactic-methodological approach on FME learning processes in intercultural teacher education.

Thus, we believe the study is important, given the need to understand the processes of initial teacher education for a specific degree programme for Indigenous peoples, grounded in knowledge from Indigenous communities and aligned with institutional pedagogical objectives. We recognise traditional knowledge as a legitimate science, even if it does not necessarily align with the Western paradigm. In this light, we propose a critical reflection on the possibilities of truly intercultural teacher education, committed to valuing epistemological diversity and developing emancipatory pedagogical practices.

Thus, this article aims to analyse the impacts of a contextualised didactic-methodological approach to financial mathematics education on the formation of Indigenous teachers, highlighting how connecting traditional and scientific knowledge expands pedagogical and epistemic possibilities in Indigenous school education. In this sense, the study is part of the special issue *Research in mathematics education and financial education: Theories, methodologies and educational products* of the journal *Acta Scientiae*, engaging with "Axis 2: Research and teaching methodologies" and "Axis 5: Inclusion, diversity, and social justice", as it addresses an educational experience in critical financial education situated in an Amazonian Indigenous context.

That said, we will now consider the study in question, taking as our starting point the space in which the formative practice with the FME and the Teaching Practicum, the FPI/Faced/UFAM course, took place.

THE INDIGENOUS TEACHER EDUCATION COURSE AS A RESEARCH LOCUS

During our itinerary, we cannot fail to highlight a must-see stop, the FPI/Faced/UFAM course, whose specific features are guaranteed by the Ministry of Education, in accordance with CNE/CP Resolution n. 1 of 7 January 2015, which establishes the National Curriculum Guidelines for the Education of Indigenous Teachers in Higher Education Courses and makes other provisions (Brasil, 2015). In the course, we see the experience of the Teaching Practicum, which also extends to research regarding the observation process, so that teaching and research become complementary processes (Vasconcelos, 2002).

The FPI/Faced/UFAM course was initially established by CEG/CONSEPE Resolution 010/2007 (approved by Resolution 032/2007), offering places through the Call for Applications for the Indigenous Teacher Education Programme (Programa de Financiamento para Licenciaturas Indígenas - PROLIND)3. In 2008, it began academic activities with classes for the Mura people in the municipality of Autazes. However, only with the publication of Resolution 041/2009, CEG/CONSEPE/UFAM, on 1st October 2009, was the course officially recognised as an Indigenous Teacher Education Course. It has since expanded its scope to include people from other ethnic groups to serve other Ethno-Educational Territories in the state of Amazonas more uniformly, namely: Médio Solimões, Alto Solimões, Alto Rio Negro, Madeira-Manicoré, and Purus-Lábrea.

In this regard, given that the 2024 classes of the FPI/Faced/UFAM course comprise Indigenous PSTs from different municipalities and ethnic groups, and although many already work as teachers in their communities, we believe that the formative experience contributes to greater appreciation and reflection on practice. This means valuing professional practice as a time for building knowledge through "[...] relationships between individuals from the same culture (intracultural) and, above all, as relationships between individuals from different cultures (intercultural)" (D'Ambrosio, 2004, p. 42). This opens a perspective on valuing research in professionals' action, laying the foundation for what Schön (1992) called the teacher-researcher.

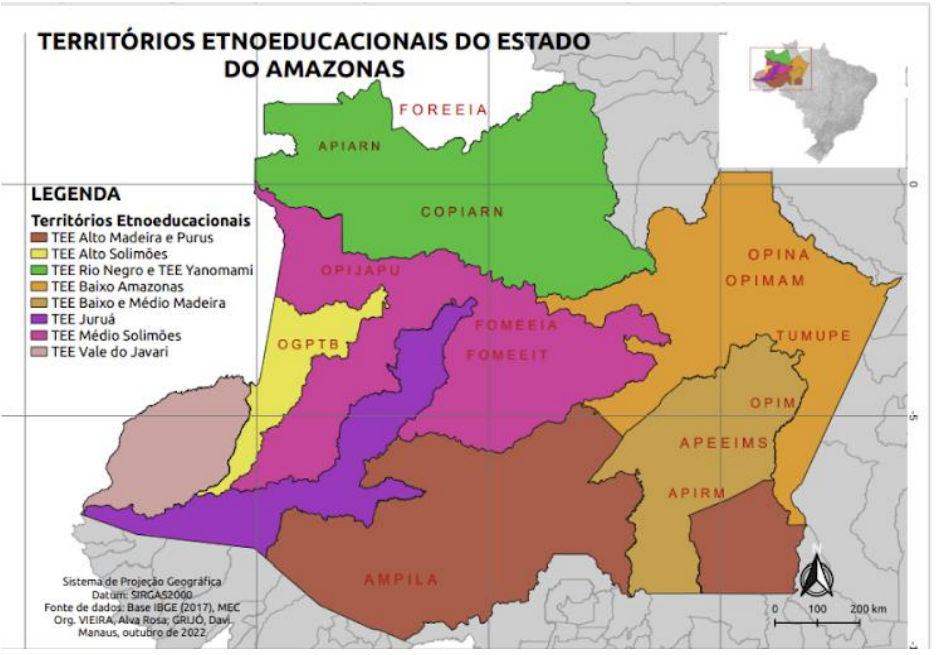
The Indigenous Intercultural Teaching Degree programme offered by UFAM, which began in 2009, has been open to ethnic groups from different regions of the state of Amazonas and, in previous cohorts, was primarily delivered in the territories, with university lecturers travelling to the Indigenous communities. Following the update of the PPC in 2023, the course began to serve ten municipalities in Lower Amazon I and II, involving various ethnic groups (UFAM, 2023), and, in 2024, it was offered for the first time at UFAM's main campus in Manaus, bringing together students from the Apurinã, Baniwa, Baré, Kambeba, Kokama, Miranha, Mura, Sateré Mawé, Tariano, Tikuna and Tukano students, from Anamã, Beruri, Careiro da Várzea, Iranduba, Itacoatiara, Manacapuru, Manaquiri, Novo Airão, Rio Preto da Eva, Tapauá, and from

3 Information about the programme is available on the website http://portal.mec.gov.br/component/tags/tag/35328.

Indigenous communities in the capital, all located in the Lower Amazon Ethno-Educational Territory (Figure 1).

Figure 1

Illustrative map of the educational territories of the state of Amazonas (Vieira, 2023, p. 106)



In this new arrangement, Indigenous PSTs travel from their communities to participate in academic activities and use the infrastructure and services available on the UFAM campus, representing a significant institutional advance in strengthening public policies for Indigenous school education in the state.

In this regard, according to the new PPC for the course, the curriculum framework consists of 87 (eighty-seven) curriculum components, organised into 9 (nine) modules. The first 4 (four) modules comprise general education for all Indigenous PSTs in initial education. From the 5th (fifth) module onward, students choose one of the following specific areas: Teaching Degree in Indigenous School Education, with an emphasis on Languages, Humanities, and Social Sciences or Natural Sciences (UFAM, 2023).

As for the organisation of the curriculum, the course follows the guidelines of CNE/CP Resolution n. 02/2019 and the guidelines of the specific National Curriculum Guidelines for Indigenous Teacher Education. Thus, the curriculum components are divided into three groups, namely:

> I – Pedagogical, Educational, and Scientific; II – Specific Content; and III – Pedagogical Practice. Formally, the groups are separate, but in practice, they are linked through "activities" based on curriculum components with practical hours, aiming to deepen and develop interdisciplinary knowledge. (UFAM, 2023, p.32–33).

Specifically, Group I corresponds to the pedagogical, educational, and scientific programme content distributed over the first two years of the course. Among these components, we find the subject Financial Mathematics Education, with the following syllabus: "Financial Mathematics of the Indigenous communities of the state of Amazonas and Brazil. Brazilian monetary system. The trade of Indigenous products. Development of sustainable financial practices and consumption in Indigenous communities. Simple interest. Compound interest" (UFAM, 2023, p. 74).

Therefore, to explore the objects of knowledge recommended in the course syllabus, we highlight its general objective: "Promoting school practices involving the marketing of products and artefacts produced in Indigenous communities to enhance activities that involve raising awareness of financial mathematics education" (UFAM, 2023, p. 74).

To meet the syllabus and objectives of the curriculum component, expository and dialogic classes were planned and prepared, as well as videos, discussion groups, and other teaching methodologies, which also included a seminar entitled "The trade of Indigenous products," which aimed to explore the commercial practices of Indigenous peoples, notions of fixed and variable costs, and pricing of their products.

In this way, new meanings are constructed about teaching and learning, i.e., education based "[...] on valuing professional practice as a moment for constructing knowledge [...]" (Pimenta & Lima, 2012, p. 144). Thus, the experiences Indigenous PSTs bring to initial teacher education foster a deeper understanding of certain topics and increase their ability to make decisions when solving problems based on their practical classroom experiences.

In the following section, we will expand on these issues and discuss the implications of the FME for the education of pre-service Indigenous teachers.

THE INITIAL EDUCATION OF INDIGENOUS TEACHERS AND THE ENCOUNTER BETWEEN THE FME AND TRADITIONAL KNOWINGS

Another important moment in this itinerary was experiencing the initial education of Indigenous teachers, which combined FME knowledge with the traditional knowings brought by the Indigenous pre-service teachers. To this end, the module was planned by contextualising the objects of knowledge in relation to the daily life of Indigenous communities, as provided for in the course's PPC. This methodological option values the presence of students' reality in the classroom, which is especially relevant in teaching mathematics, as it gives meaning to the topics covered. This perspective aligns with the National Curriculum Guidelines and with research in mathematics education that advocates using contexts close to students' reality to give meaning to school mathematics[4].

In ethnomathematics studies, D'Ambrosio (2013) argues that exploring students' lived reality is a powerful way to give meaning to mathematical concepts. Similarly, Fonseca (1995) argues that context does not replace technique but contributes to understanding it, allowing students to connect content to everyday situations in their lives. In Indigenous teacher education, this connection between school mathematics and everyday cultural practices is essential to strengthening financial mathematics education that engages with the real challenges communities face.

In daily life, we often link financial education directly to situations that require appropriate, informed decision-making. However, we seek to show that in contexts of Indigenous sociodiversity, it goes far beyond that. This topic is not just operational or limited to finance; rather, it extends to the sustainable development of the community and the planet.

In this regard, we recognise the importance of working with financial education in order[5] to understand its purpose. Thus, there is a need to research

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[4] In this article, we understand school mathematics as the set of mathematical knowledge produced, selected, and taught at school, in dialogue with students' daily lives, geared towards solving concrete problems and critically interpreting reality, and not as a neutral and decontextualised body of techniques and procedures.

[5] In this text, we use the term "financial mathematics education" (FME) to emphasise the dialogue between mathematical concepts and financial topics in the school context. When we use the term financial education, we refer to the same field but highlight the

and reflect on this topic today from the perspective of Indigenous peoples, promoting education with a critical outlook in which financial education is addressed in a way that leads Indigenous PSTs to question aspects of their daily lives. As Campos and Silva point out:

> We understand financial education as a social practice, so that it can be rooted in a spirit of criticism and in a project of possibilities that enable individual consumers to actively participate in understanding and transforming the contexts in which they are immersed (Campos & Silva, 2012, p. 13).

In everyday life, people must deal with financial situations. As inflation is constant, many Brazilian families struggle to pay their bills for water, energy, food, clothing, and other basic needs. In addition, they often encounter complex data, graphs, and spreadsheets that they do not understand, because this individual:

> [...] would not be seen as a mere consumer, endowed with a servile condition, at the mercy of a market that has been structured under a growing number of increasingly complex financial-economic information, but as a citizen who critically positions himself in relation to the scenario that has been established in the present time (Campos & Silva, 2012, p. 13).

We can link conscious consumption to financial education, which can challenge our socioenvironmental sustainability. First, we must understand that resources are limited, whether for individual use (money) or collective use (the planet and society). Another issue is balancing consumer desires with the possibilities of satisfying them, given the need to maintain a desired lifestyle. Financial education, viewed from a critical perspective, seeks to clarify its contributions to autonomous and critical integration into society.

In view of the above, the activities carried out with pre-service Indigenous teachers in the FPI/Faced/UFAM course addressed issues related to trade and other financial activities, such as handicrafts and agricultural production, in which Indigenous communities of various ethnic groups are culturally exploited. In agricultural activities, subsistence farming is practised

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broader dimension of financial practices in everyday life, always from a critical perspective and linked to FME.

within Indigenous Territories, not to sell products, but to produce surplus. This differs from handicrafts, which focus on commercialisation.

In the case of handicrafts, this activity goes beyond cultural expression; it links culture and commerce, fostering interaction between Indigenous peoples of different ethnicities and contemporary society. It connects these products with commerce and meets the demands of consumers and a society seeking balance with nature and sustainable development, since a significant portion of the raw materials used come directly from nature, such as fibres, tree trunks, or seeds. Their proper collection depends on each community's empirical knowledge, which explores various possibilities for sustainable use.

During craft production, the working day is not rigidly defined. Each artisan sets a schedule to balance craftwork with household chores and other activities that require more rigid hours, such as health and education. Thus, the time dedicated to craft activities is directly linked to service and order demands.

Although there is no set working day with a specific number of hours, craftsmanship requires skill, knowledge, and time, and the time spent producing each piece is the most complex factor to consider when pricing handmade products. It relates to the value of the labour involved, from collecting raw materials from nature through all stages of preparation to the final production of each piece.

In this context, the concept of cost-time[6] emerges, presented by the Indigenous PSTs themselves as the time spent producing handicrafts, from collecting the raw materials, preparing them (sanding, polishing, drilling, drying, dyeing, etc.), and finally weaving them to transform them into a piece of handicraft or bio-jewellery[7].

It is important to highlight that the cost-time concept defined by Indigenous PSTs refers to all the processes involved in producing a piece, starting with the collection of raw materials, which is not necessarily carried out by the artisans who will make the piece, since the process of collecting seeds, fibres, wood, leaves, and other natural products requires empirical knowledge, and this knowledge also has its value, and automatically its cost-time. Luciano (2006, p. 170) states that the main Indigenous forms of knowings:

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6 Value of the labour employed in the production of a craft item, from the collection of raw materials from nature to the final production of the craft item.

7 Fashion accessories made from organic materials found in nature, such as seeds, fibres, bones, shells, wood, bark, and plants.

> [...] are linked to their perception and understanding of nature, and are manifested in their work, rituals, festivals, art, medicine, house construction, food, drink, and even language, which always has a primordial cosmological meaning.

Thus, collecting raw materials involves contact with Mother Nature, and Indigenous peoples have maintained this relationship with Nature since birth. It is part of their way of life and culture, and they often involve their children in this collection so that this knowledge is passed on within each community from childhood. In this way, knowledge is perpetuated, especially about relationships with nature, to spread the idea that conservation and sustainable development are needed.

> Indigenous peoples have learned how forests respond to different types of disturbance and which plant and animal species emerge and proliferate at different stages of natural regeneration. They recognise certain species as indicators of soil conditions, and their traditional ecological knowledge allows them to practise adaptive management, adjusting forest impacts to maintain regeneration, even after several cultivation cycles in the same location (Chazdon, 2016, pp. 16–17).

For Indigenous peoples, nature is much more than a mere means of subsistence; it is the foundation of social life and is deeply connected to their belief systems, knowledge, and history. This relationship is not limited to physical or territorial aspects; it encompasses the environment as a whole and influences ways of life, culture, and the various forms of interaction with the natural world, a connection that is essentially social.

In line with the above, we will next discuss the methodological procedures adopted during the research carried out in the Teaching Practicum in initial teacher education to qualify Indigenous teachers in Financial Mathematics Education. Through these procedures, we have built a theoretical framework that underpins our understanding of the process experienced.

CHARACTERISING THE PATHWAY

For our path to also be in line with the rigours of academic and scientific research, a detailed plan of this pathway would be necessary; i.e., we would have to develop a methodology and its set of procedures, especially in our case, in which we chose to understand experiences within a formative process in a context of sociocultural diversity.

Based on this, the present study adopted a qualitative approach, appropriate to the nature of the object of study, as it deals with the understanding of human phenomena and their interactions with specific sociocultural contexts (Oliveira, 2016). This methodological choice is also justified because it is a study that deals with "[...] interpretations of social realities [...]" (Bauer, Gaskell, & Allum, 2003, p. 23), prioritising the subjectivity of the subjects and the complexity of the social relationships involved.

We opted for ethnographic research, given the involvement with a social group that shares specific cultural practices, knowledge, beliefs, and ways of life, as recommended by Angrosino (2009). To generate the data, two main strategies were employed: participant observation and the Formative Trajectory (Percurso Formativo), the latter adapted from Bacury's (2017) methodological proposal.

The study was conducted during the Teaching Practicum linked to the Financial Mathematics Education (FME) course, from 8 October to 27 November 2024, with the voluntary participation of 74 Indigenous pre-service teachers enrolled in the Indigenous Teacher Education (Formação de Professores Indígenas — FPI) course offered by the School of Education at the Federal University of Amazonas (Faced/UFAM). Participation was voluntary, and all participants were informed about the study's objectives, data collection procedures (diagnostic questionnaires, participant observation, and Formative Trajectories), and the academic use of the information; they signed the Informed Consent Form (ICF).

The project was not submitted beforehand to the CEP/CONEP system, as this is research conducted in the context of teacher education, linked to the course's regular teaching practices, with no additional interventions that would pose a physical, psychological, moral, intellectual, social, cultural, or spiritual risk to the participants, pursuant to Resolution n. 510 of 7 April 2016 of the Brazilian National Health Council. We take full ethical responsibility for the study and explicitly exempt Acta Scientiae and ULBRA from any consequences arising therefrom, including any need for assistance and compensation for damages to research participants, as provided for in the resolution.

To collect the information, we opted for Formative Trajectories, adapted from Bacury (2017), which consist of autobiographical writings addressing the trajectory or a time frame of the trajectory, in our case, of six Indigenous PSTs who volunteered to report their experiences — whom we consider to be research participants and who chose to be identified by capital

letters of the alphabet, through themes previously developed based on formative narratives (Ferreira, 2006).

Based on the topics covered in the Formative Trajectory and observations made during the constitutive and formative process of the Indigenous PSTs participating in the research, we chose to address the FME's contributions to trade in Indigenous products and sustainable development in their communities. This topic was divided into three parts: the first dealt with the contributions that the subject offered to the development of trade in Indigenous products; the second addressed the concepts of financial mathematics education for sustainable development; and the third covered the Indigenous PSTs' views on the possibility of socialising with their respective communities regarding the contributions of the knowledge acquired in the subject.

Furthermore, as for the narratives, we took as our basis the connections between the group of Indigenous PSTs participating in the research and the activities proposed in the subject, aiming to bring about changes and transformations in their attitudes from the moment they think about and question their actions and the theories they experience in the subject, to the point of turning them into an intentional reflection, i.e., when "[...] preparing their account, the subject lists the events, describing them in the space/time in which the action takes place, thus conveying information" (Ferreira, 2006, p. 53)

Subsequently, these narratives were subjected to a textual coding process, in which keywords were identified, and thematic categories were defined, according to the procedures described by Jovchelovitch and Bauer (2008).

Furthermore, through other information obtained via the Formative Trajectories, we brought to light some elements related to the daily lives of Indigenous PSTs, through their biographical narratives, in which they elucidated "the experience in a sequence" (Jovchelovitch & Bauer, 2008, p. 91). This tabulated material formed the framework for presenting results, describing "[...] the ways as events, realities, meanings, experiences [...]" (Braun & Clarke, 2006, p. 7) and other existing aspects.

Therefore, in the following section, we will discuss our thoughts on these pathways.

REFLECTIONS ON OUR PATHWAY

In this section, we present our reflections on this research journey, based on observations made throughout the Formative Trajectory of the

Financial Mathematics Education subject, highlighting the experiences and trajectories of Indigenous PSTs undergoing initial teacher education.

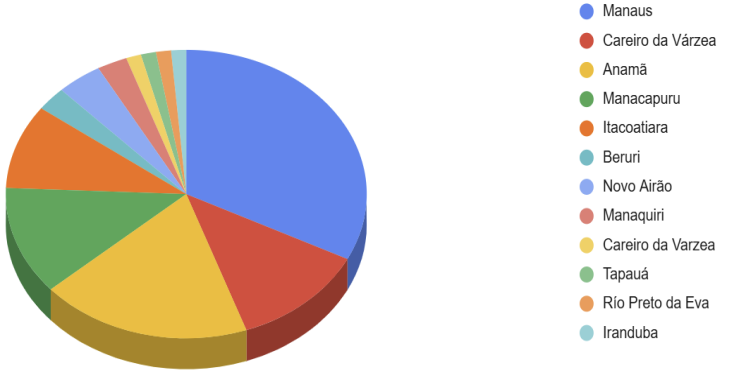
To this end, we sought to draw up a geographical, ethnic, and linguistic profile of the class using data obtained through a questionnaire administered via Google Forms; and narratives produced by six Indigenous pre-service teachers who voluntarily expressed an interest in sharing their experiences, perceptions and reflections throughout the subject. The narratives were organised into tables, and the participants, identified by pseudonyms, were represented by the initials Indigenous pre-service teachers—IPST A, B, C, and so on—to protect their identities.

Regarding the profile of the Indigenous PSTs enrolled, of the 102 (one hundred and two) pre-service teachers officially registered in the programme, 81 (eighty-one) regularly attended classes during the research period. Of these, 74 (seventy-four) responded to the questionnaire, which represents a significant response rate for qualitative and quantitative data analysis.

In terms of geographical origin, the pre-service teachers reside in Indigenous communities located in different municipalities in the state of Amazonas, namely: Anamã, Beruri, Careiro da Várzea, Iranduba, Itacoatiara, Manacapuru, Manaquiri, Novo Airão, Rio Preto da Eva, Tapauá, as well as in Indigenous communities located in the capital, Manaus. The distribution of respondents by municipality can be seen in Figure 2 below:

Figure 2

Municipalities where Indigenous Teachers' Education (FPI) reside



It is important to note that although the Lower Amazon class of the FPI course is being offered at the UFAM main campus, only 24 (twenty-four) of the 74 (seventy-four) students who responded to the survey reside in Indigenous communities in the state capital, Manaus, which reiterates the fact that Indigenous peoples occupy a wide variety of spaces and territories, including within universities.

> Indigenous peoples' pursuit of university education has been fraught with countless challenges, contradictions and tensions. This demand has been seen as yet another tool for resistance, confrontation and building new relationships with surrounding society through intercultural dialogue. The education of Indigenous teachers is part of the context of these peoples' struggle as another prominent issue in the quest for autonomy and respect for difference (UFAM, 2023, p. 6).

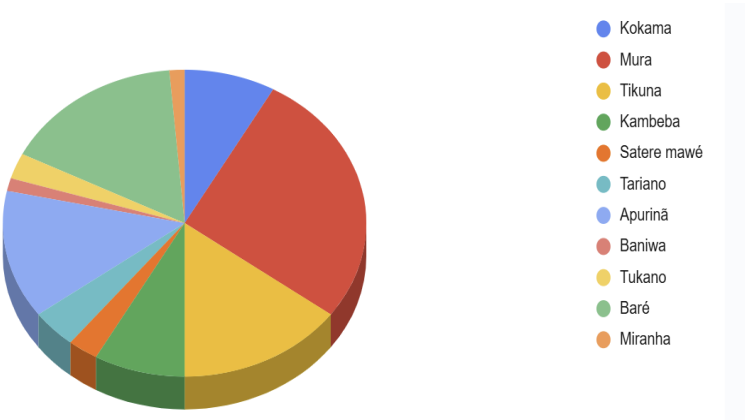
Although the presence of Indigenous people in urban centres and capital cities often causes unease among non-Indigenous people, whose perceptions view Indigenous people as bodies displaced from their usual space — which would hypothetically be in the forests,

> […] the perception that Indigenous people have a defined place leads to reactions when they are seen in urban centres. Some reactions are prejudiced, while others express concern for the well-being of women and children exposed to dire situations. However, in both cases, they reveal ignorance of this other, of their way of life, and of their legitimacy in this space, now urban (Zanin, 2017, p. 127).

Also from the profile, especially in matters relating to ethnicity, it was possible to identify that among the Indigenous PSTs, we found representatives of 11 (eleven) peoples, namely: Apurinã, Baniwa, Baré, Kambeba, Kokama, Miranha, Mura, Sateré Mawé, Tariano, Tikuna and Tukano, as illustrated in Figure 3 below.

Figure 3

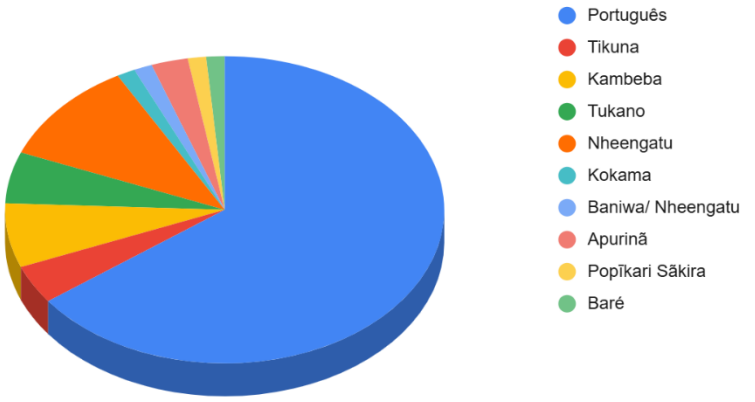
Peoples or ethnicities of FPI students



In addition to the information on the language spoken in each community, among the Indigenous PSTs, we found 48 (forty-eight) individuals who do not speak their mother tongue, speaking only Portuguese, and 26 (twenty-six) speakers of the mother tongues: Apurinã, Baniwa, Nheengatú, Baré, Kambeba, Kokama or Popikari Sãkira, as shown in Figure 4 below.

Figure 4

Native languages spoken by FPI students



It should also be noted that some Indigenous PSTs speak more than one mother tongue; among the 26 (twenty-six) mother-tongue speakers, all also

speak Portuguese, so they can be considered at least bilingual. According to the National Curriculum Framework for Indigenous Schools (Referencial Curricular Nacional das Escolas Indígenas — RCNEI), bilingualism is necessary and indispensable, as culture is expressed through language.

> These students are linguistically diverse, speakers of their mother tongues, but, due to the ambitious hands and minds of non-Indigenous people on their lands, they have been led to share the same territory, favouring coexistence through family nuclei and kinship relationships formed by Indigenous people belonging to other ethnic groups. As a result, they began to learn each other's languages, becoming speakers of more than one mother tongue within the same community of knowing and sharing (Melo, 2020, p. 221).

Thus, even if a language is the most prestigious and has the largest number of speakers, it will never exist alone, without references or "borrowings", not least because the more people speak it, the more unforgettable it will become. In other words, languages “[...] do not exist in isolation, without contact with others. Those with the greatest international prestige, mainly due to the economic power of their speakers, exert more influence than others" (Crystal, 2005, p. 62). This characteristic is observed among the 48 (forty-eight) Indigenous pre-service teachers who are not speakers of their mother tongue, as they only speak Portuguese but occasionally use "linguistic borrowings" of certain words and expressions from their people's mother tongue, just as mother-tongue speakers also do with words from Portuguese whenever they cannot find an adequate expression in their own language.

Another point raised with the Indigenous pre-service teachers was *"How can the subject of Financial Mathematics Education contribute to the trade in Indigenous products and sustainable development in Indigenous communities, as well as new perspectives on the practices of marketing products and artefacts produced in the communities?"* We will divide this into three parts: the first concerns the subject's contributions, offered in a contextualised way, to developing trade in Indigenous products.

The second part deals with the concepts of financial mathematics education and sustainable development, and finally, the third part presents the Indigenous pre-service teachers' views on the possibility of sharing the knowledge discussed in the subject with their respective communities, in order to propose a new perspective on the financial practices of Indigenous peoples,

since contextualised mathematics "[...] proves to be yet another resource for solving new problems that, having originated from another culture, involve the intellectual tools of that other culture" (D'Ambrosio, 2013). In this relationship with contexts, the educational institution must reflect critically on educational tools and practices without directing or favouring a dominant culture.

By adopting a methodology that contextualises objects of knowledge, bringing in everyday situations and problems that make sense to Indigenous PSTs, arousing their interest in solving those problems and also bringing the concept closer to their reality, we seek to develop a more proactive approach so that they interact more and can express their empirical knowledge, relating it to the theories covered in the classroom, as highlighted in the comments of IPST A.

> "Indigenous mathematics education must be differentiated and intercultural, with learning techniques based on an approach rooted in knowledge related to cultural practices, where it can be taught in real life, put into practice, and demonstrated to the people of the community" (IPST A, 2024).

In the narrative in question, we observe the desire of Indigenous PSTs to see themselves in educational processes, so as to feel represented and valued, while at the same time taking a response back to their communities, since in this course they are representatives of their respective peoples, thus understanding that "[...] the university's engagement in the formative and constitutive process of Indigenous peoples can provide an education that takes into account their cultures, [...] sociolinguistic issues and the aspirations of these communities [...]." (Bacury et al., 2023, p. 253).

Indigenous pre-service teachers' desires reflect the need for an education that recognises them as subjects of their histories and identities and, in addition to preparing them to teach, strengthens their bond with their cultures and territories, as highlighted by IPST B.

> "And it is from this new concept that we academics understand the practices and the production of mathematical knowledge that take place during classes, where this concept aligns with the everyday practices of Indigenous communities, in which, in the past, the practice and production and marketing of products — which we call income generation in Indigenous communities — were not so highly valued financially. With this new understanding, we can say that the products made in

> the communities will indeed be marketed, giving value to the work of those who make them directly [...]" (IPST B, 2024).

In light of the above, we note the projection highlighted by the Indigenous PSTs, with a view to developing the knowledge acquired in academia, thus demonstrating that the contextualisation imposed by the teachers achieved the intended objectives, among which we highlight the fact that they consider their work and its products to be valuable, and that the commercial activity carried out by non-Indigenous people needs to be understood, since they aspire "[...] to enjoy all the material and social benefits of modernity, without having to give up the right to be themselves, preserving their social logic and cosmology" (Tommasino & Mota, 2002, p. 22).

In this way, academic education becomes a means for Indigenous people to assert themselves as subjects with full rights without renouncing their traditions, but rather by finding ways to integrate them into the broader social context to guarantee their autonomy and dignity.

Regarding the second part, on the concepts of financial mathematics education and sustainable development, it is important to note that, according to Dias (2017), sustainable economic development requires that economic values not prevail over socio-political values such as solidarity, cooperativeness, and well-being. As IPST C says, the structure of the local economic organisation must preserve these values to achieve sustainability.

> "When it comes to urban Indigenous communities, this subject can contribute to an understanding of the **processes** of adaptation to the urban way of life without abandoning traditional culture, and, for example, to calculating the costs of setting up a mini agricultural system (where possible), considering ways of restoring degraded areas, and how to manage it so that it becomes a solution for providing adequate food for the family and for making a profit from selling the surplus [...]" (IPST C, 2024).

It is clear from this narrative that the financial education knowledge acquired during the subject can be applied beyond trade, buying, selling, and producing handicrafts, and into the daily lives of communities.

> Given that learning is more closely tied to the future than the past, he emphasises that the meaning of schooling for students in general, and of mathematics education in particular, is not only cognitive but also socio-political. The meaning given to

> learning is linked to the learner's social, political, cultural, and economic conditions and how they interpret them (Skovsmose et al., 2012, p. 235).

The activities that explored mathematical operations, problems involving interest calculations, percentage fractions, and other operations worked on the blackboard by the students themselves, thus developing their teaching skills, already serve as an initial teaching experience, preparing them for the time when they will socialise with their communities.

According to Tardif (2002), teaching knowledge is pluralistic knowledge, comprising knowledge related to professional training, knowings of the subjects, knowings of the curriculum, and knowings acquired from experience. Of these, the knowings gained from experience represent true teaching knowledge, as the teachers themselves produce them. Furthermore, Perrenoud (2000) points out that it is not enough for teachers to simply know the content to be taught; it is essential that they know how to link objectives and learning situations, as highlighted in the comments of IPST D.

> "Another issue I'll take back to my village is sustainable development, as well as taking better care of the rivers, streams, and springs so that the fish can live without pollution and we can have fish to eat for longer" (IPST D, 2024).

Understanding the world around us and our responsibility towards the planet is paramount and widely discussed. Thus, environmental education is not merely a means of transmitting information, but a strategy to educate citizens to be conscious and active in building a sustainable future, something the Indigenous PSTs addressed and reflected in their narratives.

We understand that sustainable development is a cross-cutting theme and can therefore be explored in any curriculum component, as Carvalho et al. tell us. (2013): "[...] to overcome problems, consolidate progress and face challenges, it is essential to link environmental education to the development of values."

As for the last part of the educational journey, concerning Indigenous PSTs' views on the possibility of socialising with their respective communities, the narratives suggest the academics' intention to move beyond school spaces and enter the communities. This learning process is not limited to improving technical skills, but also to strengthening self-awareness and empathy.

By deciding to share what they have learned with their community by giving talks in their village, this person is not only seeking personal growth, but also collective development. It takes on a role of dissemination, as highlighted by IPST E.

> "With this teaching, it opened up a whole range of possibilities, where I learned that we must always value the work we do, because there is a cost to everything, even our time. So, with everything I've learned, I'm going to take it back to my village and give talks so that my people can gain other perspectives, just like I did [...]" (IPST E, 2024).

From this narrative, we understand that professional and personal development is linked to our ability to learn from experience and put that learning into meaningful practice in our lives. The story of IPST E prompts us to reflect on how education can broaden our worldview, allowing us to recognise the importance of valuing the work we do and the resources involved, such as time.

By considering that every action has a cost, not only financial but also emotional and in terms of time, people become more aware of the value of their own effort and the impact their choices have on both their lives and the lives of others.

Thus, this professional development is a complex process in which teachers must see themselves as individuals in constant learning, capable of dealing with the various situations that arise in the school environment and in everyday classroom life (Baptista, 2010). Therefore, professional and personal development is an ongoing journey that involves both valuing our achievements and wanting to contribute to the collective good.

Therefore, the narrative of IPST E also refers us to Freire (2013), when he refutes the notion of extension that transfers or communicates without the reflective, dialogical, and transformative participation of the subjects involved in the (re)construction of knowledge, because:

> [...] requires the individual's curious presence in the face of the world. It requires transformative action on reality. It demonstrates a constant quest. It involves invention and reinvention. It calls for everyone to engage in critical reflection on the very act of knowing, through which one recognises oneself in knowing and, in recognising oneself in this way, perceives the "how" of one's knowing and the conditions to

> which one's act is subject. [...] Knowing is the task of subjects, not objects. And it is as a subject, and only as a subject, that man can truly know (Freire, 2013, p. 27).

Based on the author's statements, we understand that he presents a profound and dynamic conception of knowledge and emphasises that knowing is not a passive or mechanised action, but an active, reflective process that requires the subject's curious presence in the face of the world. In conclusion, for him, knowledge is not simply a matter of absorbing information, but involves a constant quest, a transformative action on reality and continuous reinvention.

This view considers knowledge an essentially human task that takes place through each person's subjectivity, not through an impersonal or objectified process, as is evident in the narrative of IPST F below.

> "[...] the subject opened a new field of knowledge in my academic life. It will help me to take this knowledge to my Indigenous community, such as teaching basic concepts of finance, budgeting, and investment to communities in a fair way, and managing businesses in their own villages" (IPST F, 2024).

Under this question, regarding the appreciation of the socialisation of knowledge for the benefit of the community, especially in terms of managing its businesses and finances, we are assured that this knowledge acquired in the subject can "[...] be used by society as a whole, helping communities to learn about their history, to understand the reasons for their main social problems, health, food, education, housing, environmental degradation, etc." (González Manet, 1980, p. 112).

The narrative of IPST F shows that teachers' professional identity is not given in advance but is built and rebuilt throughout their formative and professional practice in a continuous, unfinished process. In line with Imbernón's (2006) understanding of professional development, a teacher's identity is shaped by concrete formative experiences, working conditions, and the relationships they establish with students, colleagues, and communities, and not just through external prescriptions. In the context of this research, the experiences in the FME subject and in the Teaching Practicum, together with the fact that many Indigenous PSTs already work in their communities, show how the activities carried out, the new methodologies tried, and the reflections on everyday school life contribute to shifting conceptions and strengthening a

teaching identity that is more critical, reflective, and committed to Indigenous realities.

The continuity of this personal and professional development shows that education and professional growth are not limited to formal study or the beginning of one's career but extend throughout one's professional journey. Farias and Nascimento (2012) highlight that teachers' identities are strongly linked to teacher professionalisation and the relationships they establish with the profession throughout their careers. This includes not only initial education but also prior experiences and, above all, professional intervention, i.e., teaching practice.

In the context of initial education, Ponte and Oliveira (2002), in a study on the construction of knowledge and professional identity, highlighted the importance of reflecting on practice. The results indicated that the subject contributed significantly to promoting a reflective attitude among the participants. This point of view emphasises that teachers' identities are not fixed but are shaped by both their academic education and their practical experiences in educational contexts.

Teacher professionalisation, therefore, is not limited to education but encompasses the entire career, including experience and continuous reflection on practice. This suggests that the teacher's identity is dynamic, shaped by interactions with the profession, pedagogical practices, and the challenges they face in everyday classroom life.

In short, these students' narratives highlight the need for education that recognises them and their stories within the teaching and learning process in academic spaces. Regarding the knowledge acquired about FME, we understand that the financial organisation's structure implemented in its villages must preserve economic values to achieve sustainability. In other words, the FME should be present in the villages not only in terms of trade, buying, selling, and producing handicrafts, but in all aspects of community life.

This perspective promotes the free and equitable dissemination of knowings, encouraging collaboration and collective progress in various fields of knowledge. By treating knowledge as a shared asset, we reinforce the importance of making it accessible and democratising it, giving everyone the opportunity to learn and contribute.

WHAT WE LEARN FROM THIS PATHWAY

At the end of this journey, we present the memories we will take with us from this pathway, a formative experience anchored in methodology, research, and teaching through a Teaching Practicum in Financial Mathematics Education, within a context of inclusion and diversity during the initial education of Indigenous teachers.

This experience highlighted the contributions of a methodological approach that values the contextualisation of knowledge objects in the teaching and learning process of Indigenous pre-service teachers (IPSTs) in initial education. Furthermore, it demonstrated the potential to share this knowledge within the home communities of the Indigenous PSTs participating in the research, promoting awareness of sustainable development and appreciation of the products they make and trade among themselves and with non-Indigenous businesses.

When observing the knowledge topics taught in the Financial Mathematics Education subject that took Indigenous sociodiversity into account, we noticed that Indigenous pre-service teachers were engaging more with the subject, contributing to actions that go beyond school spaces and encouraging the sharing of the knowledge acquired in the Indigenous communities from which these students originate, both in their schools and in other community spaces, in order to help promote local culture and trade.

The narratives of the Indigenous pre-service teachers taking the Financial Mathematics Education subject highlighted educational opportunities that simultaneously focus on academic education, professional development, and pedagogical practice for current and pre-service teachers. By incorporating issues close to the realities experienced in the communities, the subject broadened participants' understanding of financial concepts, strengthened their autonomy and cultural identity, and fostered new insights into the sustainability of their territories. By recognising products, community practices, and traditional knowledge as significant elements in the teaching-learning process, the experience helped teachers become more critical and committed to social transformation and the preservation of their territories and traditions.

In view of the above, we believe the activities organised and carried out during the subject added new knowledge about the teaching and learning processes of financial mathematics education and contributed to the development of Indigenous pre-service teachers' professional identity in initial teacher education.

The Teaching Practicum in the Financial Mathematics Education subject, carried out as part of the Indigenous teacher education course, was a privileged educational moment in which we could articulate issues through the concrete experience of an intercultural and contextualised proposal. By closely monitoring the planning, the development of the classes and the active participation of the Indigenous PSTs in the Lower Amazon class, we broadened our perspective on the power of FME when it is anchored in the knowings, economic practices, and future plans of the communities, which in turn informed and refined the questions of the thesis.

In this experience, the practicum ceases to be merely a matter of fulfilling credits and becomes a space for research and reconstruction of professional identity, highlighting the importance of choosing classes and curriculum components that relate to the research topic. At the same time, it reinforces the understanding that the Teaching Practicum can make a decisive contribution to consolidating studies that integrate Financial Mathematics Education and the specific socio-cultural realities of Indigenous peoples.

The study also highlighted the relevance of a contextualised approach in Financial Mathematics Education for Indigenous teachers by integrating mathematical knowledge with Indigenous peoples' socio-cultural practices. The link between traditional knowings and formal education has made it possible not only to redefine mathematical concepts, but also to value local business practices and strengthen sustainable development in communities.

Furthermore, we found that Financial Mathematics Education, anchored in the principles of solidarity, cooperative action, and well-being, goes beyond the simple transmission of technical content and serves as a tool for strengthening sustainable social and economic practices. Initial education, by engaging with students' experiences, fostered an investigative and reflective stance, fundamental to building teacher identity in the Indigenous context.

Therefore, the importance of degree courses specifically for Indigenous peoples is reaffirmed, with pedagogical practices that incorporate the FME subject alongside other approaches that recognise the sociocultural specificities of Indigenous pre-service teachers and promote teacher education to help them mediate between traditional knowledge and scientific knowledge. These formative pathways with Indigenous pre-service teachers reinforce the understanding that knowledge should be seen as a collective, accessible, and transformative asset, committed to individual emancipation and the building of more just and sustainable societies.

AUTHORSHIP CONTRIBUTION STATEMENT

RCM and GRB conceived the idea presented. RCM developed the didactic-methodological proposal, carried out the formative activities and collected the data. RCM and GRB analysed the data. GRB supervised the study. RCM drafted the initial version of the text. All authors actively participated in discussing the results and reviewed and approved the final version of the work.

DATA AVAILABILITY STATEMENT

The corresponding author, RCM, will make the data supporting the results of this study available upon reasonable request.

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