

BUILDING LITERACY AND NUMERACY IN MULTILINGUAL CLASSROOM: A CRITICAL REVIEW OF PEDAGOGICAL STRATEGY AND POLICY CHALLENGE IN TIMOR-LESTE

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Abstract

Literacy and numeracy are the competencies that facilitate lifelong learning, but their development is one of the major challenges in the multilingual setting, as happens in Timor-Leste. This paper represents a critical literature review, which synthesises current research, policy reports, and educational practices to investigate the barriers and opportunities to learn literacy and numeracy in primary schools. The results indicate that systemic limitations, language barriers between home and school languages, and a lack of pedagogical materials are barriers to successful learning. Specifically, the prevalence of Portuguese as the language of instruction has been known to interfere with early childhood learning among children, and the lack of teacher training leads to the worsening of inequalities in classroom performance. However, the review identifies new strategies that can boost student engagement and performance. The new strategies include mother tongue/translingual approaches, culturally responsive teaching, multiliteracies, and the incorporation of literacy and numeracy education in both local and social contexts. The evidence shows that literacy and numeracy are interdependent and that teacher professional development is conclusive. The review concludes that long-term development demands consistent language policies, an equal distribution of resources, and education for teachers. An inclusive, contextual approach can foster academic achievement and other wider objectives of equity and social cohesion within the education system in Timor-Leste.

Keywords: Literacy, numeracy, multilingual education, culturally responsive pedagogy, Timor-Leste.

Introduction

Literacy and numeracy are core competencies that support both academic and long-term cognitive learning in students. Such abilities are especially vital in primary school, where children receive their basic education. But in a multilingual environment like Timor-Leste, there are a variety of challenges in the development of literacy and numeracy. The educational system in Timor-Leste is characterised by a linguistically diverse environment (Portuguese and Tetum are the official languages); however, in the homes of many students, multiple indigenous languages are used (Caffery et al., 2016). This language complexity affects students' literacy and numeracy skills because the language used to teach them may differ from their home language. Recognising this issue, the National Basic Education Curriculum was introduced to enhance the educational process for learners and destroy the language barrier in education (Cassity et al., 2022). All these improvements, nevertheless, the issue of language barriers, a lack of teaching materials, and the training of teachers continue to be considerable (Ximenes, 2025). To address these

concerns, it is necessary to discuss the approaches that can effectively streamline the process of learning literacy and numeracy in a multilingual environment.

Despite different interventions carried out to enhance literacy and numeracy levels among Timor-Leste undergraduates, their use is not properly facilitated due to several challenges that persist. The mismatch between their first language and the language they study hinders most students from understanding lessons. This is made worse by the fact that there are no well-trained teachers who can manage the multilingual classrooms. Additionally, instructional resources that are consistent with the lingual backgrounds of the students tend to be insufficient to prompt instructors to provide sufficient education. This problem is only compounded by the inconsistency in the implementation of the curriculum in various regions. Research indicates that even with some advancements, the literacy and numeracy learning outcomes remain inadequate (Department of Foreign Affairs & Trade [DFAT], 2015). This gap suggests that it is necessary to critically analyse current policies and instructional approaches, as well as reconsider and review them, to meet the needs of the multilingual student population in Timor-Leste.

There is an increasing amount of research evidence that multiliteracies pedagogy, culturally relevant teaching resources, and teacher capacity-building programmes can improve literacy and numeracy outcomes in multilingual classrooms. It has been determined that multiliteracies pedagogy, where diverse forms of communication and expression are encouraged and cultural expression takes place, can promote student engagement and student learning. Teaching strategies, including culturally relevant materials, can also help students to learn more meaningfully and in ways that are context-related. Also, improved student performance can be achieved through specific teacher training programmes, which can provide the skills for teaching in a multilingual classroom. The practices will guide teachers and policymakers to co-create an exemplary and inclusive learning process with Timor-Leste students.

Research Questions

1. How do we intend to build literacy and numeracy in multilingual primary classrooms in Timor-Leste? What are the main approaches to it?
2. What are the main issues for teachers and learners in such situations?
3. What can be done to improve current strategies to improve educational results?

Recent studies also propose that translingual pedagogies and culturally responsive instructional practices gain special significance in multilingual classrooms. Research has established that, when the home language of students is used in the learning experience, students are highly engaged and their academic results are enhanced. Multiliteracies pedagogy is already practically feasible since it acknowledges the factuality of the heterogeneity of people with respect to language and integrates incongruent modes of literacy, for instance, visual, digital, and written modes of communication (Fonseca et al., 2023). Researchers have also found that translingual approaches to adult literacy positively influence identity-related and community literacy practices (Mora et al., 2023). These

results indicate that the same strategies may be implemented in primary education in Timor-Leste to enhance literacy and numeracy achievement.

Literature Review

Theoretical Foundation

The emergence of literacy and numeracy in the multilingual classrooms of Timor-Leste can be best approached using the sociocultural theory of Vygotsky and Cole (1978), who focused on the idea that learning is socially mediated, with language being the key in cognitive development. Students in these classrooms usually speak Tetun, Portuguese, and even regional languages, and teachers in such classes have to navigate through the different linguistic environments. Boon (2013) discovered that teachers and learners regularly alternate languages, using Tetun for teaching and Portuguese for technical explanations, which demonstrates how multilingual contact facilitates learning processes. Boon and Kurvers (2015) also noted that although Tetun is the official language of instruction, not all learners understand it, and thus the informal nature of regional languages fills the comprehension gap. Nevertheless, there are still structural bottlenecks in the form of poor teachers' training and a lack of policy support. These results confirm that cultural and linguistic tools influence learning, a fact that has been supported by Vygotsky and Cole (1978), which illustrates the significance of the responsive and language-conscious pedagogies in multilingual classrooms.

Importance of Literacy and Numeracy in Multilingual Contexts

Multilingual contexts pose both challenges and opportunities for the development of literacy and numeracy, particularly in low- and middle-income countries where issues of language policy intersect with equity in education. A review of research has indicated that children who learn in their mother tongues build stronger foundations for understanding and critical thinking—two essential skills that are at the heart of further learning (Nakamura et al., 2023). When children have access to knowledge in their native language, they are able to use their cultural and language resources to relate new knowledge to their experience. Frequently, such an approach is a more productive way for learning to occur than teaching in a foreign language first. O'Connor et al. (2018) show, for example, that multilingual children in Australia who benefit from high levels of support in their home languages and in the language of instruction at school are more likely to do well in their academic endeavours. These findings echo the Timor-Leste context, where the shift to Portuguese as the medium of instruction tends to disrupt children's learning routes, given that many start school with very little experience of the language.

This language switch primarily impacts students' achievement in literacy and numeracy. As Jorgensen and Graven (2021, 2022) say, the integration of literacy and numeracy practices into multilingual early years can contribute to equity – but only if instruction embraces students' linguistic repertoires. There is still a lot of information that is not culturally and linguistically appropriate in Timor-Leste. Piper et al. (2018) stress that literacy and numeracy progress would not only depend on teacher training but would also

depend on a structured teaching guide and adequate textbooks. Hence, for policymakers and teachers in multilingual societies, we need to contemplate integrated approaches based on students' home languages and also build on their multilingual practices instead of approaches based on a single official language of instruction.

Teaching Strategies to Build Literacy

One of the most promising among the many literacy pedagogy spaces for a multilingual context is multiliteracies pedagogy: the extension of conventional literacy challenges (reading and writing) to multimodal communication representations (visual, audio, and digital literacies) (Fonseca-Mora and Sosinski, 2023). By recognising that students are exposed to and make meaning of information in a variety of ways, multiliteracies pedagogy helps learners to connect with content in more profound ways. Franco et al. (2019) demonstrate that children in multilingual environments can generalise their literacy and numeracy activities through play, indicating that learning environments with multiple, adaptable modes of communication help build foundational skills.

Furthermore, it has been indicated that using the home languages of children in literacy teaching helps create more links between their prior knowledge and new information being presented to them. The practice helps not only in understanding but also serves to verify the identity and cultural background of the students and makes them more motivated and active. Another key aspect of the development of literacy is parental involvement. Conica et al. (2023) show that parents' use of decontextualised language in preschool plays an important role in achieving literacy in middle childhood. This underscores the importance of families being involved in literacy practices such as shared reading/storytelling that link home and school settings.

Best Multilingual Classroom Pedagogy

The key to responding to the challenges of multilingual classrooms is culturally responsive teaching. In the context of the given approach, the instructors would need to alter the teaching a bit to render it culturally and linguistically competent for the students, which in its turn would render the process meaningful and relevant. Linguistic diversity, as a professional development program, can positively impact the classroom because experience with the ALMA program in Timor-Leste has already been proven effective (Cassity et al., 2022). Vasoya and Vansdadiya (2023) emphasise the importance of teaching basic literacy and numeracy through methods that are both developmentally sufficient and contextual.

Currently, despite improvements, challenges persist in achieving a sustainable system-wide implementation of these practices. The preparedness of teachers is not evenly distributed, and the resources of lifelong learning are not always abundant. However, Dasan (2025) states that the role of teachers in the promotion of literacy and numeracy cannot be ignored, especially when teachers are provided with pedagogical resources that would reflect the realities of their students. Multilingual classrooms should therefore be the focus of long-term investment in teacher education, teacher mentorship, and culturally responsive curriculum to transform classroom practice.

Strategies for developing numeracy skills

Pedagogies that provide a connection between abstract concepts and the daily experience of students in a multilingual setting are useful in teaching mathematics. Chang (2023) notes that early development of literacy and numeracy skills is a strong predictor of improved mathematics performance in the future, suggesting that numeracy teaching should be grounded in the solid foundations established during early childhood. Cassity et al. (2023) assert that practical problems and stories function as a linguistic bridge connecting students' language backgrounds with mathematics.

Importantly, reports have indicated that teaching mathematics in local languages facilitates understanding and participation. According to Nuryati et al. (2024), language learning and mathematical literacy are better supported through numeracy literacy strategies in early childhood when introduced in languages the children understand. Furthermore, Krisdianti et al. (2025) found that applying the process of teaching numeracy in the school environment, along with interaction and contextualisation, leads to more comprehensive skill development. Teachers can make mathematics seem significant to students by framing numeracy as a cognitive and a social practice.

Culturally Relevant Materials, Numeracy Instruction

Inclusion of culturally relevant examples in teaching numeracy has been defined as a potent instrument to enhance student learning. According to Reder et al. (2020) and Ghanem (2020), the cultural and community contexts of numeracy practices not only increase engagement but also position learning as an ongoing activity. Indicatively, students can relate abstract mathematical concepts to their everyday experiences when teachers apply familiar cultural practices, such as local means of measurement, local games, or market solutions to problems.

As strategies targeting adult learners have demonstrated, the combination of literacy and numeracy in meaningful practices also produces greater long-term proficiency (Reder et al., 2020). The same can be applied to primary education, where the experiences of students outside the school become an asset to classroom teaching. These results can be achieved by means of strategies that embed numeracy within a cultural context to bridge the gap between home and school learning, as well as understanding and recall. The fact that both literacy and numeracy are interdependent within multilingual contexts underscores the need to use integrated, culturally responsive pedagogy. Integrating literacy and numeracy practices in the early years may help introduce greater equity in teaching for students with multilingual backgrounds (Jorgensen and Graven, 2022). For this reason, policy makers and teachers working for organisations such as Timor-Leste need to be attentive to teacher development, culturally appropriate teaching materials, and parental engagement as part of their overall approach to school performance (Vygotsky and Cole, 1978). Incorporating literacy and numeracy instruction into the linguistic and cultural realities of students can provide schools with a stronger foundation for learning.

Research Methodology

The research followed the critical literature review methodology to review the available literature concerning the subject and identify positive strategies and outstanding issues in the development of literacy and numeracy in multilingual primary classrooms with particular reference to Timor-Leste. It is informed by the synthesis and evaluation of a wide variety of academic literature, policy reports, and teaching reports to see what patterns, contradictions, and gaps exist in the knowledge stock (Snyder, 2019). An iterative review offers an opportunity to provide substantive evidence-based cases for further research and policy development through the critical synthesis of the literature (Booth et al. 2016).

The scope of the review has been as broad as possible, with sources chosen based on methodological rigour, relevance to multilingual education, and, in particular, pedagogical novelty. An important part of this approach is the inclusion of studies directly relevant to the Timor-Leste context, for instance, the multi-year report on teacher preparation presented by Cassity et al. (2022) and general observations on the success of the multilingual classes (O'Connor et al. 2018). In addition, the review also includes literature regarding foundational skills and their influence on future educational outcomes to provide a broader understanding of the issues at hand (Chang 2023; Conica et al. 2023).

The researcher systematically searched the academic databases such as Google Scholar, Scopus, and ERIC to discover the relevant data. The keywords that reflect the issue of interest were successfully identified, for example, literacy and numeracy in multilingual education, primary education in Timor-Leste, and teacher professional development in multilingual environments. The search strategy also included specific pedagogical strategy terms such as 'mother-tongue instruction' and 'multiliteracies' (Fonseca-Mora & Sosinski, 2023). Furthermore, to ensure essential policy context, the review included an analysis of the documents of the Ministry of Education of Timor-Leste and international sources, such as those of the United Nations Organisation, the Educational, Scientific, and Cultural Organisation (UNESCO), and the World Bank. The selection of the literature was thematically grouped to support in the comparative analysis of various pedagogical approaches and how they relate to the practical situation of Timor-Leste.

This review was analysed by the thematic synthesis method (Thomas and Harden, 2008), which enabled the identification and detailed exploration of several common themes in numerous studies. Another theme is the language of instruction, which looks at the effectiveness of early learning in the mother tongue and is based on results from large-scale systematic reviews (Nakamura et al., 2023) and research studies on literacy and numeracy practices involving multiple languages (Jorgensen and Graven, 2021; Jorgensen and Graven, 2022). The second theme is teacher professional development, in which the review drew together what is known about the components that are necessary to further develop literacy and numeracy, including structured guidance and coaching (Piper et al., 2018). Pedagogical strategies and curriculum adaptations were addressed, among them play-based learning (Franco et al., 2019) and other practical approaches for the facilitation

of learning basic competencies in the early childhood years (Nuryati et al., 2024; Vasaya and Vansdadiya, 2023). The other point of interest was the role of the teacher as a promoter of basic literacy and numeracy (Dasan, 2025; Krisdianti et al., 2025). This review critically discussed the discrepancies in the results and identified areas where future empirical studies may be needed, such as the practice engagement theory for adult students (Reder et al., 2020), which could be applied to teacher education. This study uses a systematic thematic analysis to make evidence-based recommendations for improving literacy and numeracy teaching in multilingual primary schools in Timor-Leste (Gough et al., 2017).

Results and Discussion

Language of Instruction Issue

The reviewed literature analysis has revealed that the dilemma of language is one of the most enduring issues of the development of literacy and numeracy in the multilingual classrooms of Timor-Leste. The institutionalisation of the Portuguese and Tetum languages is sometimes at odds with the native languages that students use at home, and this creates a discrepancy between language life and school demands. This disjunction impedes the development of basic literacy and numeracy skills, particularly in the early stages of schooling.

Large-scale evidence, which has been collected in low- and middle-income countries, indicates that children who receive instruction in their native language in their first years of school acquire a better command of critical thinking, their ability to comprehend, and problem-solving skills (Nakamura et al., 2023). However, in Timor-Leste, the natural learning pathways are disrupted by the premature transition to Portuguese and put the children in a greater cognitive burden (O'Connor et al., 2018). As the findings of this review indicate, the existing language of instruction policy is one of the primary impediments to literacy and numeracy achievement, especially in rural communities where Portuguese is not prevalent.

The findings indicate the significance of translingual and mother-tongue-based approaches. The inclusion of local languages during elementary school not only increases interest but also minimises disparities in learning performance. There is also evidence in other multilingual settings (Jorgensen and Graven, 2022) that home languages are part of the learning environment, which enhances equity in literacy and numeracy.

Teacher Preparation and Professional Development

The second outstanding discovery is how teachers are central in the achievement of literacy and numeracy. Although the country has a number of professional development programmes, including the ALMA programme and in-service workshops with the assistance of external agencies, teacher preparation is unequal across the country (Cassidy et al., 2022). Most of the teachers still feel unprepared in managing multilingual classrooms, especially when they are supposed to teach in Portuguese, which is not necessarily their best language.

The reviewed studies demonstrate that integrating professional development into ongoing, context-specific mentorship and coaching is more effective than treating it as a one-time training session. According to Piper et al. (2018), the enhancement of literacy and numeracy levels requires not only teacher training but also systematic direction and access to teaching resources. Systemic gaps in pre-service and in-service education are evident in the differences in teacher capacity in Timor-Leste.

The results suggest that targeted investments in teacher education programs—particularly those that focus on multilingual pedagogy, classroom management, and culturally responsive practices—are important. We cannot overestimate the role of teachers as facilitators of basic literacy and numeracy (Dasan, 2025). Their capacity to situate lessons, flexible multilingualism, and ability to relate the classroom material to the reality students live in directly affect the results of learning.

Culturally Responsible and Multiliteracies Pedagogy

These findings also support the increasing importance of multiliteracies pedagogy in helping develop literacy in multilingual classrooms. The pedagogy of multiliteracies goes beyond the traditional concept of reading and writing by integrating visual, digital, and oral communications; therefore, the various modes of meaning-making are recognised by students (Fonseca-Mora and Sosinski, 2023).

Franco et al. (2019) reveal the fact that multilingual children can expand literacy and numeracy activities by means of play, proving the significance of multimodal learning. Equally, parental participation, namely storytelling, reading, and decontextualised language practices, improves the link between home and school learning (Conica et al., 2023). Such strategies not only enable understanding but also cultural identity and serve as motivation to learners.

In particular, culturally responsive teaching deals with the realities of the Timorese classrooms. Examples of events that are based on the cultural and linguistic contexts of the students facilitate the process of learning. To illustrate, the inclusion of local narratives, community activities, and oral traditions in reading and numeracy instruction not only makes the classes more engaging (Vygotsky and Cole, 1978) but it also authenticates the cultural heritage of students. The findings underscore the fact that culturally responsive pedagogy is not an optional thing but a requirement that should be made to establish equal learning environments in a multilingual environment.

Numeracy instruction based on local and contextual practices

The results indicate that numeracy teaching is best done in a manner based on the everyday lives of learners. Learning mathematics through local languages and culturally related situations, e.g., by doing computations in a market, using traditional systems of measurement, and playing local games, has significant linkages between the abstract ideas and life. Investigations conducted in Timor-Leste and similar contexts support this strategy. Cassity et al. (2023) claim that practical problem-solving is a linguistic interface that bridges the gap between students' native languages on one side and the abstract discourse of mathematics on the other side. Nuryati et al. (2024) also prove that the

application of numeracy strategies in known languages at an early age promotes a higher level of understanding and engagement.

The review also reveals that we should present numeracy as a social practice, not just a cognitive one. Interaction in the classroom, group activities, and solving problems together assist in placing mathematics as a daily skill or activity, rather than an academic exercise in a vacuum (Krisdianti et al., 2025). This observation highlights the importance of integrating numeracy instruction in social and cultural contexts to increase retention and practice (Vygotsky and Cole, 1978).

Literacy and numeracy practices

The reviewed literature emphasises that literacy and numeracy are interdependent and mutually reinforcing. Combining these two areas, e.g., storytelling with counting or play-based activities, which combine reading and solving problems, helps strengthen either of these competencies at the same time. Specifically, play-based learning has been shown to enhance literacy and numeracy practices in a multilingual environment (Franco et al., 2019). Similarly, parental participation in storytelling and reading together helps develop language, cognitive, and numerical reasoning (Conica et al., 2023). These integration strategies enhance academic capacity and make learning more interactive because they promote a holistic approach.

In Timor-Leste, a country with minimal resources, literacy and numeracy learning are practical because they are efficient methods that enable learners to maximise their learning. This approach also promotes equity by allowing heterogeneous students to access both home and school resources while acquiring core competencies.

Recurrent Systemic and Resource Limitation

Despite these promising practices, systemic barriers continue to hinder progress. The review shows that many schools do not have enough textbooks, structured guides, and culturally relevant materials, which restricts teachers from using inclusive strategies (Piper et al., 2018). Differences in curriculum implementation across various regions, along with variations in teacher readiness, further exacerbate these issues.

Despite the success of pilot programs and individual interventions, the challenge lies in scaling them up to a national level. Without a systemic provision of teacher development, resources, and curriculum adaptation, the benefits of localised programmes for the education system could be fleeting. Therefore, the results underscore the necessity for improved policy coordination and sustained investment. The education of teachers, the curriculum, and community involvement should be coordinated to address the structural disparities that continue to affect literacy and numeracy rates in Timor-Leste.

Synthesis and Implications

The evidence highlights both issues and strengths. On the one hand, major challenges include the prevalence of Portuguese as the language of instruction and the unpreparedness of teachers. Alternatively, multiliteracies pedagogy, mother-tongue instruction, and culturally responsive teaching provide specific strategies of improvement (Vygotsky and Cole, 1978). These findings suggest to policymakers that systemic changes

are necessary to align language policy, teacher training, and curriculum development with the multilingual nature of Timor-Leste. The findings suggest that teachers should acknowledge the importance of incorporating cultural and linguistic resources into their classroom practices.

The critical analysis of the literature reviewed also highlights the ongoing gap in the area, especially with respect to the thorough empirical research on the existence of productive multilingual pedagogy in primary school. Conceptual frameworks, policy reports, and small-scale case studies offer information that is insightful about the potential of mother-tongue instruction, multiliteracies approaches, and culturally responsive teaching, but empirical evidence that can be conducted in a way that evaluates these strategies is still scarce and needs to be conducted in more context-specific ways. This weakness limits the capacity of policymakers and educators to come up with interventions that can be scaled and sustained. Future studies should therefore go beyond descriptive narratives to embrace rigorous methodological designs – i.e., longitudinal studies, classroom-based experiments, and mixed methods – that can help researchers understand how multilingual pedagogies can affect literacy and numeracy outcomes in a very nuanced way. The findings would not only become part of the global debate on equity in multilingual education but also become a source of evidence that is specific to the realities of Timor-Leste in terms of a sociolinguistic perspective.

Conclusion

This review concludes that the limitations to the development of literacy and numeracy in the multilingual classrooms of Timor-Leste are relatively large and are primarily due to weaknesses in the system, linguistic inconsistencies, and sustained resource shortages. Nevertheless, the results demonstrate innovative approaches through the introduction of multilingual, culturally sensitive, and well-structured pedagogical strategies. These approaches promote student interaction and contribute to a higher level of academic achievement by correlating classroom knowledge with the sociocultural context of students.

Importantly, the evidence shows that effective and consistent policies that recognise the multilingual nature of Timor-Leste society, along with the provision of proper resources and effective teacher training programs, are keys to sustained improvement. The preparation of teachers turns out to be a critical variable, as prepared teachers can mediate linguistic diversity, use inclusive practices, and promote integrated numeracy and literacy practices. Moreover, because of the mutual dependency between literacy and numeracy, there is a need to incorporate them both in holistic and highly contextualised curricula.

Finally, an interdisciplinary and context-sensitive practice is not only about academic success. It can also help mitigate inequalities, promote equity, and enhance social cohesion. Timor-Leste's education system may shift towards more sustainable and

equal learning among all students by harmonising pedagogy, language policy, and teacher development.

Recommendations

According to the results of this review, it is possible to make several recommendations that would enhance the scope of literacy and numeracy acquisition in the multilingual classrooms of Timor-Leste:

1. Embrace mother-tongue or translanguage instruction in the lower grades of education to minimise the impairments brought about by language disparities. Home language, in addition to Portuguese and Tetum, can be used to facilitate understanding, promote equity, and establish more robust platforms of literacy and numeracy acquisition.
2. Focus on practice-based, long-term teacher training programmes that will equip teachers with strategies for managing multilingual classes. We need to create continuous mentorship, coaching, and professional learning communities to maintain teacher growth and confidence.
3. Promote inclusion of the culturally relevant examples, multimodal communication (oral, visual, and digital), and community-based practices in teaching. This will confirm the cultural identities of the students, besides ensuring that the teaching and learning of literacy and numeracy become more interactive and significant.
4. Ensure schools receive pedagogical resources and instructional materials relevant to their language and culture. The policies should ensure equitable resource allocation among regions to reduce discrepancies.
5. Establish a curriculum and teaching techniques that view literacy and numeracy as mutually reinforcing skills. Use play-based, project-based, and family-engaged learning techniques to reinforce both domains.
6. Enhance greater cooperation between families, policymakers, and schools. Community engagement, particularly parent involvement in storytelling, reading, and daily numeracy activities, should extend learning beyond the classroom to the community.

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