International Conference on Education, Economics, Law, and Technology

Vol. 1, No 1, June 2026

THE BALINESE COUNTING SYSTEM IN COMPARATIVE PERSPECTIVE: ETHNOLINGUISTIC STRUCTURE AND PSYCHOLOGICAL IMPLICATIONS FOR EARLY NUMERACY

Putu Wulandari Tristananda[1], I Komang Sesara Ariyana[2], I Made Suweta[3]

[1,2,3]Institut Agama Hindu Negeri Mpu Kuturan, Bali, Indonesia

e-mail: putuwulandari.trista@gmail.com

K E Y W O R D

Balinese Language;
Counting System;
Early Numeracy;
Ethnolinguistics;
Ethnopedagogy.

A B S T R A C T

This article presents a focused ethnolinguistic case study of the Balinese counting system, situated within a comparative perspective drawing on Bahasa Indonesia, Javanese, and selected typologically contrastive systems documented in the cross-linguistic numerical-cognition literature. Drawing on linguistic relativity theory, number sense theory (Dehaene, 2011; Feigenson, Dehaene, & Spelke, 2004), learning-trajectories research (Sarama & Clements, 2009), and Vygotskian sociocultural psychology, the article examines how the ethnolinguistic architecture of Balinese numerals—its decimal base, culturally distinctive suppletive forms (*selae*, *seket*, *satus*), rich numeral classifier inventory (*bidang*, *katih*, *bungkul*, *ukud*, *diri*), embedding within *sor–singgih* speech registers, and ritual–cosmological resonances—shapes psychological pathways for early-numeracy development. In this study, early numeracy refers to foundational mathematical competencies developed by children aged approximately 3 to 8 years (PAUD/TK and SD kelas 1–2 / Fase A under Indonesia's *Kurikulum Merdeka*). The comparative analysis indicates that Balinese counting constitutes a culturally distributed cognitive resource currently underutilised in early-grade mathematics instruction. The article argues for an ethnopedagogically informed approach that treats the Balinese counting system as a scaffolding resource for cardinality, classification, and magnitude reasoning, and outlines implications for curriculum design, teacher preparation, and future empirical research.

INTRODUCTION

Indonesia, a nation of more than seven hundred living languages, offers an unusually rich laboratory for such investigations. Yet its heritage counting systems remain marginal to the international literature, which has overwhelmingly focused on East Asian, European, and selected Papuan traditions. The Balinese language is a particularly compelling case: it sustains a vibrant ethnolinguistic tradition (Suweta, 2020) in which numeration is embedded in ritual practice, in trade and domestic activity, and in a layered system of speech-level registers known as *sor-singgih* (Suweta et al., 2023). Balinese children typically acquire their first numerical lexicon within this richly contextualised environment before encountering Bahasa Indonesia—and, increasingly, English—in the formal classroom (Tristananda, 2019).

A persistent tension emerges from this trajectory. In the implementation of the Indonesian *Kurikulum Merdeka*, the foundational phase (Fase A) of primary mathematics is delivered in Bahasa Indonesia, with limited systematic use of the heritage counting lexicons that children bring from home (Prapnuwanti et al., 2024). The cognitive resources embedded in Balinese numeration are thereby separated from formal

mathematical instruction at precisely the developmental window in which the connection between language and number is most consequential. Recent Indonesian scholarship has begun to address this gap from the side of mathematics education (Ariyana, 2022; Wiguna et al., 2025), but a comprehensive ethnolinguistic–psychological synthesis remains absent.

Bali offers a particularly compelling site for such inquiry. The Balinese language, an Austronesian language of the Bali–Sasak–Sumbawa subgroup, possesses an elaborate decimal numeral system that combines pan-Malayic regularities with culturally specific suppletive forms reflecting historical mercantile practices and ritual–cosmological structures. Yet Balinese children today are typically taught primary mathematics in Bahasa Indonesia, the national language of instruction, with little explicit recognition of the cognitive scaffolding their heritage counting system provides. Recent empirical work in ethnomathematics has begun to document Balinese counting practices and their educational potential (Payadnya et al., 2025), but a systematic ethnolinguistic and psychological analysis of the Balinese counting system in comparative perspective is still lacking.

This article addresses two guiding questions: (1) How does the structural architecture of Balinese numerals differ from that of the instructional language (Bahasa Indonesia) and from typologically contrastive reference systems? (2) What are the developmental and pedagogical consequences of these structural differences for early numeracy among Balinese children? The article first sets out the theoretical framework and methodology; describes the Balinese counting system; presents a comparative analysis; discusses implications for number sense and early numeracy and for the implementation of *Kurikulum Merdeka* Fase A in Bali; and closes with a discussion and directions for future research.

METHOD

The study employs a focused ethnolinguistic case study with comparative perspective. The rationale combines the depth of single-case description with the explanatory leverage of cross-system comparison. The Balinese counting system functions as the focal case; Bahasa Indonesia, Javanese, and selected typologically contrastive systems serve as structured reference points against which Balinese features are interpreted.

The corpus comprises: (a) ethnolinguistic and grammatical descriptions of Balinese, particularly analyses of speech levels and lexical structure (Arka, 2005); (b) recent ethnomathematics scholarship documenting Balinese counting practices in commerce and education (Payadnya et al., 2025); (c) the cross-linguistic numerical cognition literature (Miller et al., 1995; Pica et al., 2004); (d) developmental and cognitive psychology of early numeracy (Dehaene, 2011; Feigenson et al., 2004; Sarama & Clements, 2009); (e) Indonesian ethnomathematics literature (Muhtadi et al., 2017; Prahmana et al., 2021; Turmuzi et al., 2022); and (f) Indonesian curriculum and policy documents, particularly the Capaian Pembelajaran for Matematika Fase A (Kemendikbudristek, 2022).

The analytical procedure has two stages. First, typological coding maps the structural features of the Balinese numeral system: base structure, regularity of teen and decade formation, suppletive forms, numeral classifiers, and register-sensitive variants. Second, thematic synthesis links these structural features to documented psychological and pedagogical findings from the comparative literature. Three limitations should be acknowledged. First, the study draws on secondary sources rather than primary empirical data, and the conclusions are hypotheses to be tested rather than findings to be generalised. Second, Balinese language documentation is asymmetric: some registers and counting practices are better described than others. Third, the comparative reference set is selective, prioritising languages that are pedagogically relevant (Bahasa Indonesia, English) or that occupy informative positions in the linguistic relativity literature.

RESULTS

This section presents the results in two parts. Sections 3.1 and 3.2 address RQ1 by describing the ethnolinguistic architecture of Balinese numerals and comparing it with reference systems. Sections 3.3 and 3.4 address RQ2 by drawing out the developmental and pedagogical consequences of these structural features for early numeracy among children aged 3 to 8.

1. The Ethnolinguistic Architecture of Balinese Numerals (RQ1)

Balinese employs an elaborate decimal numeral system whose surface form reveals both pan-Malayic regularities and culturally specific innovations. The basic cardinal numerals 1–10 are *besik* (1), *dua* (2), *telu* (3), *(em-) pat* (4), *lima* (5), *(e-) nem* (6), *pitu* (7), *(a-) kutus* (8), *(a-) sia* (9), and *(a-) dasa* (10). Each basic form has a combining form used to construct higher numerals (e.g., *petang-* for 4, *limang-* for 5) and an independent form often produced by reduplication. High-register (*basa alus*) variants of certain numerals are borrowed from Sanskrit, notably *kalih* (2) and *tiga* (3), which substitute for the low-register forms in formal speech (Arka, 2005). Beyond ten, the system employs a combining strategy broadly similar to Bahasa Indonesia and Javanese, but with several morphological irregularities that warrant close attention.

A first feature of psychological interest is the presence of suppletive numeral forms at culturally salient values. Twenty-five is expressed as *selae* (*sa-laé*), historically derived from "one thread of twenty-five Chinese coins"; fifty is *seket*, etymologically "one tie of two threads"; eighteen is the suppletive *pelekutus*; forty-five is *setimahan* or *setiman*"; and seventy-five is *telung-benang*, "three threads [of coins]." These forms reflect the historical embedding of Balinese counting in the coin economies of the pre-colonial archipelago and constitute lexicalised irregularities that the young learner must acquire by rote rather than by morphological decomposition.

A second feature is the existence of a dedicated 'tweens' series for the numbers twenty-one through twenty-nine, formed with the suffix *-likur* (*selikur* '21', *dualikur* '22', *telulikur* '23', and so on). This series is structurally parallel to, but lexically distinct from, the teens series (*solas* '11', *rolas* '12', *telulas* '13'). The tens above thirty are formed regularly with the combining form of the unit plus *dasa* (*telung-dasa* '30', *petang-dasa* '40'), with the exceptions of *seket* '50' and forty-five noted above. Hundreds are formed with *atus* (*satus* '100', *telung-atus* '300'), and there are dedicated terms for two hundred (*satak*), four hundred (*samas*), one thousand (*siu*), and ten thousand (*laksa*), several of which derive from the lexicon of traditional commerce.

A third feature, of central importance for ethnopedagogical analysis, is the embedding of the numeral system within the *sor-singgih* speech-level system. The *sor-singgih* distinguishes between *basa kasar* (low register), *basa madya* (middle register), and *basa alus* (refined or high register), and certain numerals possess register-specific doublets. The numbers two and three, for example, have *basa alus* combining forms *kalih-* and *tigang-* (themselves of Sanskrit origin) alongside the *basa kasar* forms *duang-* and *telung-*. The choice between *kalih-likur* and *dua-likur* for twenty-two thus encodes social and ritual information in addition to numerical content. This intertwining of numerical and social meaning has been documented for other domains of the Balinese lexicon, including religious terminology (Suweta, Susila Putra, & Tristananda, 2023) and culinary vocabulary (Suweta, 2018a), and is a defining characteristic of the language as a vehicle of cultural knowledge (Suweta, 2020).

A fourth feature is the rich inventory of numeral classifiers. Balinese, like many Austronesian languages, requires a classifier between the numeral and the counted noun in many phrasal contexts. The classifier *bidang* is used for flat or sheet-like objects (mats, pieces of cloth); *katih* for stick-like or elongated objects (cigarettes, sticks of incense, individual stalks); *bungkul* for round or globular objects (fruits, eggs); *ukud* for animals; and *diri* (or in *basa alus*, *jadma*) for persons. The use of classifiers is not optional and is acquired alongside the cardinal numerals themselves, with consequences for the cognitive representation of quantity that will be considered in Section 6.

A fifth feature concerns the use of numerals in ritual and calendrical contexts. Balinese employs the Saka calendar and the elaborate *pawukon* cycle of thirty *wuku*, with specific numerical configurations carrying religious significance. Counting practices associated with offerings (*banten*), ceremonial implements, and ritual periods are embedded within these systems and exposed to children from an early age through household and community participation. Such practices instantiate a form of culturally distributed numerical cognition in which the meaning of a number is inseparable from its ritual context.

A sixth feature is the contemporary coexistence of Balinese numeration with Bahasa Indonesia in everyday life: in urban and peri-urban settings, code-switching between the two languages is the norm, and Balinese children typically operate from an early age within a bilingual numerical environment. Balinese numerals compared with Bahasa Indonesia reveal a pattern of partial overlap and systematic divergence. The

two systems share a base-ten architecture and overlapping etymological roots for the smaller cardinals (Balinese *lima*, Bahasa Indonesia *lima* 'five'; Balinese *dasa*, Bahasa Indonesia *sepuluh* 'ten'). However, Bahasa Indonesia exhibits a more regular morphological surface in the upper numerals (*dua puluh lima* '25', *lima puluh* '50') than Balinese (*selae* '25', *seket* '50') and lacks the dedicated 'tweens' series. From the standpoint of transparency theory, Bahasa Indonesia is therefore the more regular system above ten, with implications for the cognitive load of early counting acquisition (Miller et al., 1995).

Balinese numerical practice extends beyond cardinal counting. The Balinese calendrical system articulates concurrent cycles—the seven-day *saptawara* and the five-day *pancawara*—and the 210-day *pawukon* cycle that emerges from their combination. Determination of *otonan* (the 210-day birthday observed in Balinese Hindu tradition) requires implicit modular arithmetic embedded in lived ceremonial practice. Payadnya et al. (2025), studying the "*Wa Pat Nem Tus Dasa*" counting system among 50 participants across eight regencies in Bali, report that this mod-2 grouping system supports arithmetic learning by reinforcing modular reasoning, pattern recognition, and logical grouping in early-grade contexts.

2. Balinese in Comparative Perspective (RQ1)

(a) Balinese vs. Bahasa Indonesia. Bahasa Indonesia, the language of formal mathematics instruction, employs a transparent decimal system in which place-value structure is morphologically clear: *dua puluh tiga* (23) renders as "two tens three". By comparison, the Balinese system is more morphologically opaque: the suppletive forms *selae* (25) and *seket* (50), the dedicated *-likur* suffix for the 21–29 range number, and the fixed-form bundle terms all require children to acquire irregular, non-rule-based forms rather than apply a productive base-ten rule. By the criteria advanced by Miller et al. (1995), Bahasa Indonesia is closer to the transparent end of the continuum, while Balinese contains substantial irregularities that may slow the early acquisition of higher-number counting.

(b) Balinese vs. Javanese. Balinese and Javanese share a substantial common substrate, reflecting both genetic kinship and long-standing cultural contact. The *-olas* teen pattern, the *-likur* twenties pattern, and the *seket*/*selawe* suppletive forms all show clear cognates. Their shared opacity in the 20–100 range is therefore not Bali-specific but a regional Austronesian-Indic synthesis, suggesting that any cognitive consequences will be common across Balinese and Javanese children.

3. Hypothesised Developmental Consequences for Early Numeracy (RQ2)

Three developmental consequences follow from the structural features identified above. First, the morphological opacity of Balinese in the 20–100 range predicts a cognitive cost similar to that documented for English-speaking children in the cross-linguistic literature. Children who must learn that 25 is *selae* (rather than a transparent "two-tens-five" construction) cannot bootstrap higher numerals from a base-ten rule but must memorise fixed-form forms. By analogy with Miller et al. (1995), one would predict that children growing up monolingually in Balinese might lag slightly behind Bahasa Indonesia–dominant peers in early counting fluency at the 20–100 range, although they may exceed them on tasks where the cultural-historical content of suppletive forms is activated.

Second, the numeral classifier system invites children to perform conceptual classification simultaneously with counting. Saying "two pencils" in Balinese requires choosing *katih* (*dua katih pinsil*) to mark the elongated shape of the referent. This may scaffold early conceptual development in domain knowledge of object types, supporting cardinality through a richer semantic encoding. By the framework of Sarama and Clements (2009), classifier languages may yield slower initial counting trajectories but richer connections between number and the qualitative properties of counted sets.

Third, the cultural-historical embedding of Balinese counting—in coin denominations, ritual cycles, and market practices—constitutes a culturally distributed resource for early numeracy in the sense of Vygotskian mediation (Vygotsky, 1978). The 210-day *pawukon* cycle and the calculation of *otonan* involve real (if implicit) modular reasoning. Payadnya et al. (2025) report that traditional Balinese merchants efficiently apply a mod-2 grouping system in daily trade, and that elementary teachers in Bali recognise its potential for strengthening students' counting skills and engagement. Core competencies targeted by *Kurikulum Merdeka*

Fase A—pattern recognition, grouping, additive reasoning—are thus already partially scaffolded by everyday Balinese practice.

Most Balinese children today grow up in a bilingual or trilingual context, hearing Balinese at home and learning Bahasa Indonesia—and increasingly English—in schooling. For Balinese children, the central practical issue is not the existence of bilingualism but the asymmetric prestige of the codes involved: Bahasa Indonesia and English carry institutional authority, while Balinese is increasingly relegated to domestic and ritual contexts. The resulting risk is not numerical confusion but cognitive impoverishment, as the rich cultural-historical encoding of Balinese counting falls out of children's active repertoire.

4. Pedagogical Consequences for Kurikulum Merdeka Fase A (RQ2)

The implementation of *Kurikulum Merdeka*, with its emphasis on contextualised learning and Teaching at the Right Level, offers a well-timed moment for ethnopedagogical innovation in Balinese early-grade classrooms. The Learning Outcome for Mathematics in Fase A specifies that children develop number sense up to 100, perform addition and subtraction within 20, recognise simple patterns, and understand half and quarter fractions (Kemendikbudristek, 2022). All of these competencies have counterparts in traditional Balinese counting practice. The implications of the analysis for early-grade mathematics education in Bali can be organised around six principles.

a. First, the Balinese counting lexicon should be treated as a cognitive asset rather than as an obstacle. Children entering PAUD/TK and Fase A typically arrive with a working command of the Balinese cardinal numerals, classifiers, and ritual counting practices; this command is a scaffolding resource for the construction of formal mathematical concepts (Ariyana, 2022).
b. Second, instructional design at the Fase A level should incorporate systematic bridging between the Balinese counting lexicon and the Bahasa Indonesia mathematical lexicon. Children can be invited to count in Balinese before counting in Bahasa Indonesia, to use classifiers in both languages, and to recognise the structural correspondences between the two systems. Such bridging supports rather than impedes the development of Bahasa Indonesia mathematical fluency, and aligns with the integration principle articulated by Prapnuwanti et al. (2024) for the integration of local culture into *Kurikulum Merdeka*.
c. Third, teacher preparation in Bali should include explicit linguistic awareness training. Teachers who themselves speak Balinese are nonetheless not always equipped to leverage the structural properties of the language for mathematical instruction. The integration of structural-linguistic and ethnomathematical content into pre-service and in-service teacher education for PAUD and SD teachers in Bali is a high-leverage point for curriculum reform; recent work on culturally embedded mathematics textbooks for prospective elementary teachers in Bali (Wiguna et al., 2025) offers an initial template.
d. Fourth, materials development should produce culturally responsive resources that incorporate Balinese counting practices into worksheets, songs, manipulatives, and digital learning tools. Recent work on technology-supported mathematics instruction for elementary students in Bali (Suardipa et al., 2025) provides a methodological template for the integration of digital media with culturally embedded content.
e. Fifth, assessment practices should be designed to accommodate bilingual numerical reasoning. Standardised assessments conducted exclusively in Bahasa Indonesia underestimate the numerical competence of children whose dominant home language is Balinese and obscure the very ethnolinguistic resources that an ethnopedagogically informed curriculum is designed to leverage.
f. Sixth, policy implementation of *Kurikulum Merdeka* Fase A in Bali should explicitly recognise the role of Balinese as a heritage language with cognitive as well as cultural value. The integration of local culture into the *Kurikulum Merdeka* framework has been articulated as a policy direction (Prapnuwanti et al., 2024), but its operationalisation for mathematics education at Fase A remains underdeveloped. These six implications constitute a research and development agenda rather than a finished pedagogical programme; their realisation will require sustained collaboration between linguists, mathematics educators, developmental psychologists, and teachers, and a willingness to treat ethnolinguistic diversity as an asset for cognitive development rather than as a problem to be managed.

A final note concerns the emerging trilingual classroom. As English instruction expands in Indonesian primary education, Balinese children face an environment in which Balinese, Bahasa Indonesia, and English differ markedly in their counting systems' transparency. Innovative early-grade English instruction should attend to the structural parallels and contrasts between English and Balinese—both contain irregular teen forms—leveraging Balinese as a familiar reference point. This is the precise terrain on which a collaboration between ethnopedagogically informed mathematics education and innovative English-language pedagogy can yield genuinely new pedagogical resources.

DISCUSSION

1. Synthesising the Costs and Affordances of Balinese Numeracy

The four sub-findings reported in above can be read as a single coherent picture rather than four separate observations. Balinese counting, considered as a cognitive system, is neither uniformly advantageous nor uniformly disadvantageous for early numeracy; it is a structured tradeoff. The morphological opacity of the 20–100 range imposes a memory cost similar to that documented for English-speaking children (Miller et al., 1995); the obligatory numeral classifiers impose an additional categorical workload during enumeration; the *sor–singgih* register system requires sociolinguistic monitoring during numerical tasks. At the same time, the suppletive forms carry cultural-historical content that may enrich semantic representation rather than diminish it; the classifier system scaffolds qualitative–quantitative integration in line with Sarama and Clements's (2009) emphasis on rich relational understanding; and the cultural embedding of counting in *pawukon*, *otonan*, and market practices provides a culturally distributed cognitive resource. The central question for educational design is whether these affordances can be activated in ways that offset the costs—a question that the present synthesis renders tractable, even though it cannot resolve it empirically.

2. Theoretical Contributions

Three theoretical contributions emerge. First, the analysis extends linguistic relativity research on number cognition to a typologically distinctive Austronesian system that has been underrepresented in the cross-linguistic literature. Second, it shows that the cognitive costs of morphological opacity coexist, in Balinese, with culturally distributed scaffolding resources in the Vygotskian (1978) and ethnomathematical (D'Ambrosio, 1985) tradition—the two perspectives are not competitors but complementary lenses on the same heritage system. Third, the analysis shifts the Indonesian ethnomathematics conversation, currently concentrated on geometry, measurement, and games (Muhtadi et al., 2017; Prahmana et al., 2021; Turmuzi et al., 2022), towards the largely unexplored territory of the heritage numerical lexicon itself.

3. Significance for the Indonesian Education Context

The analysis returns to the paradox identified in introduction. Indonesia hosts one of the world's richest concentrations of linguistic diversity yet performs poorly in international numeracy assessments (Kemendikbudristek, 2023). The conventional response to such paradoxes is to treat linguistic diversity as an obstacle to standardisation. The present analysis suggests the opposite: the very features of heritage languages that look like obstacles in a standardisation framework—opacity, classifiers, registers—turn into resources in an ethnopedagogically informed framework. *Kurikulum Merdeka*'s commitment to contextualised learning and Teaching at the Right Level provides the policy infrastructure within which such a reframing can be operationalised at scale, particularly in Bali where the heritage language remains comparatively vital. The trilingual classroom—Balinese at home, Bahasa Indonesia as language of instruction, English as emerging subject—is the practical site at which this reframing must be enacted, and it is precisely the site where collaboration between mathematics-education and English-language pedagogy can yield genuinely new instructional designs.

CONCLUSION

This focused ethnolinguistic case study has examined the Balinese counting system in comparative perspective, identifying five structural features—decimal base, morphological opacity in the 20–100 range, culturally embedded suppletive forms, obligatory classifier system, and embedding within *sor–singgih*

registers—and tracing their hypothesised consequences for early numeracy among children aged 3 to 8. The analysis shows that Balinese counting constitutes a culturally distributed cognitive resource: simultaneously a system that imposes morphological and sociolinguistic costs and one that offers cultural-historical, classificatory, and ceremonial-modular affordances. The pedagogical task of *Kurikulum Merdeka* Fase A is to activate these affordances within the policy frame of contextualised learning.

Three priority directions for future research follow. First, longitudinal studies of early-numeracy trajectories in Balinese–Bahasa Indonesia bilingual children, with comparison to monolingual Bahasa Indonesia peers. Second, design-based intervention research in Fase A classrooms that integrates Balinese counting practices into the *Kurikulum Merdeka* would operationalise the pedagogical recommendations above and yield empirical evidence for or against the ethnopedagogical hypothesis. Third, systematic documentation of register-sensitive numerical expressions in Balinese ritual and trade contexts is needed before further gradual language loss makes such documentation impossible. Indigenous cognition, sustained over centuries in everyday Balinese practice, deserves a central place in the early-numeracy classroom—not as decoration but as cognitive substrate.

REFERENCES

[1] Ariyana, I. K. S. (2022). Pentingnya membelajarkan konten aljabar dan keterampilan berpikir aljabar untuk anak usia dini. *Jurnal Pembelajaran dan Pengembangan Matematika (Pemantik)*, 2(1), 1–10. https://doi.org/10.36733/pemantik.v2i1.3704

[2] Arka, I. W. (2005). Speech levels, social predicates and pragmatic structure in Balinese: A lexical approach. Pragmatics, 15(2–3), 169–203. https://doi.org/10.1075/prag.15.2-3.04ark

[3] Badan Pengembangan dan Pembinaan Bahasa. (2024). Identifikasi dan validasi 718 bahasa daerah dan 778 dialek di Indonesia. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. https://badanbahasa.kemdikbud.go.id/

[4] Badan Pusat Statistik. (2022). Long Form Sensus Penduduk 2020: Penggunaan bahasa di lingkungan keluarga. BPS. https://sensus.bps.go.id/

[5] D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. For the Learning of Mathematics, 5(1), 44–48.

[6] Dehaene, S. (2011). *The number sense: How the mind creates mathematics* (Rev. and updated ed.). Oxford University Press.

[7] Feigenson, L., Dehaene, S., & Spelke, E. (2004). Core systems of number. Trends in Cognitive Sciences, 8(7), 307–314. https://doi.org/10.1016/j.tics.2004.05.002

[8] Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. (2022). Capaian Pembelajaran Mata Pelajaran Matematika Fase A–Fase F untuk SD/MI, SMP/MTs, dan SMA/MA pada Kurikulum Merdeka. Badan Standar, Kurikulum, dan Asesmen Pendidikan. https://kurikulum.kemdikbud.go.id/file/cp/dasmen/10.%20CP%20Matematika.pdf

[9] Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. (2023, Desember 5). Peringkat Indonesia pada PISA 2022 naik 5-6 posisi dibanding 2018 [Siaran Pers]. https://www.kemdikbud.go.id/main/blog/2023/12/peringkat-indonesia-pada-pisa-2022-naik-56-posisi-dibanding-2018

[10] Miller, K. F., Smith, C. M., Zhu, J., & Zhang, H. (1995). Preschool origins of cross-national differences in mathematical competence: The role of number-naming systems. Psychological Science, 6(1), 56–60. https://doi.org/10.1111/j.1467-9280.1995.tb00305.x

[11] Muhtadi, D., Sukirwan, Warsito, & Prahmana, R. C. I. (2017). Sundanese ethnomathematics: Mathematical activities in estimating, measuring, and making patterns. Journal on Mathematics Education, 8(2), 185–198. https://doi.org/10.22342/jme.8.2.4055.185-198

[12] Payadnya, I. P. A. A., Atmaja, I. M. D., Noviyanti, P. L., Wibawa, K. A., & Jayantika, I. G. A. N. T. (2025). Exploring "Wa Pat Nem Tus Dasa": The potential of a Balinese traditional mod 2 counting

system in culturally based mathematics learning. Journal for Multicultural Education, 19(4), 448–459. https://doi.org/10.1108/JME-02-2025-0050

[13] Pica, P., Lemer, C., Izard, V., & Dehaene, S. (2004). Exact and approximate arithmetic in an Amazonian indigene group. Science, 306(5695), 499–503. https://doi.org/10.1126/science.1102085

[14] Prahmana, R. C. I., Yunianto, W., Rosa, M., & Orey, D. C. (2021). Ethnomathematics: Pranatamangsa system and the birth-death ceremonial in Yogyakarta. Journal on Mathematics Education, 12(1), 93–112. https://doi.org/10.22342/jme.12.1.11745.93-112

[15] Prapnuwanti, N. L. P., Susanti, K. D., Darma, I. W. W., Sastrawan, K. B., & Tristananda, P. W. (2024). Kurikulum merdeka belajar terintegrasi budaya lokal. *Jurnal Penelitian dan Pengembangan Pendidikan*, 8(1), 33–40. https://doi.org/10.23887/jppp.v8i1.68661

[16] Sarama, J., & Clements, D. H. (2009). Early childhood mathematics education research: Learning trajectories for young children. Routledge.

[17] Suardipa, I. P., Trisniawati, Nirmayani, L. H., Ariyana, I. K. S., & Yudiana, I. K. E. (2025). The impact of project based learning model with Articulate Storyline on decimal numbers learning outcomes of students. *International Journal of Elementary Education*, 9(2), 213–222. https://doi.org/10.23887/ijee.v9i2.100317

[18] Suweta, I M. (2018a). Istilah kosa kata kuliner Bali. *Purwadita: Jurnal Agama dan Budaya*, 2(1), 1–8.

[19] Suweta, I M. (2018b). Membangun kalimat tunggal dan kalimat majemuk dalam bahasa Bali (kajian deskriptif). *Widyacarya: Jurnal Pendidikan, Agama dan Budaya*, 2(2), 1–10.

[20] Suweta, I M. (2019). Bahasa dan sastra Bali dalam konteks bahasa dan sastra Jawa Kuna. *Widyacarya: Jurnal Pendidikan, Agama dan Budaya*, 3(1), 1–9.

[21] Suweta, I M. (2020). Bahasa Bali dalam pengembangan pengetahuan (perspektif pengetahuan etika dan estetika). *Maha Widya Bhuwana: Jurnal Pendidikan, Agama dan Budaya*, 3(2). https://doi.org/10.55115/bhuwana.v3i2.958

[22] Suweta, I M., Susila Putra, M., & Tristananda, P. W. (2023). Bunyi bahasa sebagai simbol manifestasi Tuhan dan kosmos dalam budaya Hindu di Bali. *Maha Widya Bhuwana: Jurnal Pendidikan, Agama dan Budaya*, 6(1), 90–101.

[23] Tristananda, P. W. (2019). Cultural borrowing bahasa Sansekerta–bahasa Bali. *Maha Widya Bhuwana: Jurnal Pendidikan, Agama dan Budaya*, 2(2), 1–11.

[24] Turmuzi, M., Sudiarta, I. G. P., & Suharta, I. G. P. (2022). Systematic literature review: Etnomatematika kearifan lokal budaya Sasak. Jurnal Cendekia: Jurnal Pendidikan Matematika, 6(1), 397–413. https://doi.org/10.31004/cendekia.v6i1.1183

[25] Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press.

[26] Wiguna, I. K. W., Handayani, N. N. L., & Ariyana, I. K. S. (2025). The effectiveness of a mathematics textbook embedded with Mpu Kuturan's values on prospective elementary teachers' numeracy skills. *Indonesian Values and Character Education Journal*, 8(1), 23–29. https://doi.org/10.23887/ivcej.v8i1.96687