



Joyful Learning in Elementary Mathematics: A Multi-Site Case Study of Teacher Strategies and Student Engagement in Tomohon City

Deysti T. Tarusu^{1*}, Junita C. Makawawa², Navel O. Mangelep³

^{1,2}Primary Education Study Program, FIPP, Universitas Negeri Manado, North Sulawesi, Indonesia

³Mathematics Education Study Program, FMIPAK, Universitas Negeri Manado, North Sulawesi, Indonesia

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ABSTRACT

Purpose: This study examines the challenges of implementing Joyful Learning in primary school mathematics instruction across four public schools in Tomohon City, North Sulawesi, addressing the gap between national curriculum policy endorsement of student-centered pedagogy and its actual classroom practice. **Methods:** A qualitative multi-site case study design was employed involving 12 mathematics teachers and 60 students across urban and peripheral schools. Data were collected through 48 classroom observations, semi-structured interviews, lesson plan (RPP) analysis, school assessment reports, and a student engagement questionnaire, analyzed using Miles and Huberman's (2014) interactive model. **Findings:** Only 25% of observed lessons incorporated joyful elements (40% urban vs. 10% peripheral schools). Student engagement averaged 2.3 out of 5.0, with 65% reporting persistent confusion and average achievement scores of 65/100. **Research Implications:** Effective Joyful Learning requires sustained mathematics-specific teacher professional development, equitable resource allocation, and structured community engagement programs. Policymakers should develop ready-to-use joyful mathematics modules aligned with Kurikulum Merdeka objectives and establish dedicated infrastructure funding for peripheral schools. **Originality:** This study provides the first multi-site empirical evidence of Joyful Learning implementation in a mid-sized Indonesian city, revealing how urban-peripheral resource disparities systematically determine pedagogical innovation outcomes at the primary school level.



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INTRODUCTION

Mathematics education in primary schools plays a crucial role in shaping foundational skills that support students' cognitive development and long-term academic success. Despite its centrality in the curriculum, mathematics is frequently perceived by young learners as abstract, intimidating, and disconnected from their everyday experiences. This widespread negative perception contributes to low motivation, high anxiety, and suboptimal learning outcomes, particularly at the elementary level where foundational concepts are introduced (OECD, 2025). In Indonesia, the national curriculum most recently reformed under the Independent Curriculum or Kurikulum Merdeka—emphasizes competency-based, student-centered learning. However, implementation in practice often falls short of these ideals, with many teachers continuing to rely on conventional lecture-based methods that fail to engage students meaningfully (Susanto & Retnawati, 2022).

Among the promising pedagogical innovations gaining traction in Indonesian education is Joyful Learning, a student-centered approach that integrates play, creativity, and positive emotions to enhance the overall learning experience. Rooted in constructivist theory, Joyful Learning seeks to reduce cognitive load while promoting intrinsic motivation through activities such as educational games, storytelling, hands-on manipulatives, and collaborative group tasks (Fredricks et al., 2019). The theoretical underpinnings of this approach draw heavily from Vygotsky's (1978) sociocultural theory, which emphasizes the role of social interaction and scaffolded learning in cognitive development, as well as Deci & Ryan, (2000) Self-Determination Theory, which highlights the importance of autonomy, competence, and relatedness in fostering intrinsic motivation. In the context of elementary mathematics education, Joyful Learning has demonstrated potential in reducing math anxiety and strengthening conceptual understanding by making abstract mathematical concepts more tangible, relatable, and enjoyable.

Empirical evidence supporting the efficacy of Joyful Learning in mathematics is growing. Research conducted in Indonesian classrooms has consistently identified insufficient professional training, large class sizes, and limited resources as primary obstacles to implementation (Kurniawan et al., 2023). Internationally, teachers who received sustained professional development in play-based learning reported significantly higher implementation fidelity and student engagement outcomes compared to those with minimal training (Chen & Yang, 2022).

Despite the growing body of empirical support for Joyful Learning, critical gaps persist in the literature. Much of the existing research has been conducted in controlled or well-resourced settings, limiting the applicability of findings to schools in developing countries where structural constraints are pervasive. In Indonesia specifically, the translation of constructivist pedagogical ideals into everyday classroom practice has been systematically hampered by resource inequalities, insufficient teacher preparation, and entrenched cultural norms that privilege rote learning and examination performance over experiential discovery (Suyanto, 2021). Although the Independent Curriculum (Kemdikbudristek, 2022) explicitly endorses student-centered approaches, including Joyful Learning, as the preferred pedagogical paradigm for primary education, national policy endorsement has not been matched by corresponding systemic investments in teacher professional development, instructional materials, or equitable resource allocation. This discrepancy between policy aspiration and classroom reality represents a critical implementation gap that demands empirical investigation, particularly at the primary school level where foundational mathematical dispositions are formed.

A central dimension of this implementation gap concerns teacher professional development and self-efficacy. Research consistently demonstrates that teachers who lack subject-specific training in Joyful Learning strategies tend to revert to conventional lecture-based instruction, even when they hold positive attitudes toward student-centered pedagogy in principle (Pajares, 1992). This pattern is particularly pronounced in Indonesian primary schools, where professional development programs are often generic, infrequent, and disconnected from the specific demands of mathematics instruction. Bandura, (1997) theoretical framework of self-efficacy offers a compelling explanation for this dynamic: teachers' confidence in implementing innovative approaches is contingent upon the quality and relevance of their prior training experiences. When professional development fails to provide mathematics-specific guidance, teachers lack the mastery experiences necessary to sustain pedagogical innovation, creating a self-reinforcing cycle in which conventional methods persist by default. This cycle is further exacerbated by the structural conditions of many Indonesian classrooms, where large class sizes averaging 25–30 students per teacher, combined with pressure to complete national curriculum targets, leave little time or space for the exploratory, game-based activities central to Joyful Learning (Kurniawan et al., 2023).

From the students' perspective, the affective and motivational dimensions of mathematics learning are equally consequential. Self-Determination Theory Deci & Ryan, (2000) posits that sustained engagement in learning activities depends on the satisfaction of three fundamental psychological needs: autonomy, competence, and relatedness. In mathematics classrooms characterized by teacher-dominated instruction, students rarely experience genuine autonomy or a sense of competence, particularly when they struggle with abstract content. Joyful Learning addresses these deficits by embedding mathematical concepts within play-based activities that afford students agency, social connection, and achievable cognitive challenges (Fredricks et al., 2019). Empirical evidence from Indonesian and regional contexts corroborates this theoretical prediction: Sari et al., (2021) found that students in joyful learning classrooms reported significantly higher levels of intrinsic motivation and lower mathematics anxiety compared to peers in conventional instruction groups. Similarly, research across Southeast Asian contexts documents a consistent negative correlation between play-based pedagogical approaches and mathematics anxiety, with the strongest effects observed among students who enter the intervention with the lowest baseline confidence (Else-Quest et al., 2010). These findings suggest that the motivational and affective benefits of Joyful Learning are not merely incidental but are structurally embedded in the design of learning experiences that honor students' need for enjoyment and social connection.

Beyond individual teacher and student factors, the broader socio-cultural and institutional context plays a determinative role in shaping whether Joyful Learning can take root in any given school environment. Hofstede, (2011) cross-cultural research highlights that educational systems rooted in collectivist values and hierarchical teacher-student relationships often resist pedagogical innovations that prioritize student autonomy and playful exploration, as these are perceived to undermine academic seriousness and examination preparation. In the Indonesian context, this cultural resistance is compounded by parental expectations that equate disciplined drill-and-practice with academic rigor. Comparative international evidence reinforces this structural argument: countries where play-based mathematics learning has been successfully institutionalized, such as Finland and Singapore, share common enabling conditions including equitable resource distribution, sustained school-embedded professional development, and strong cultural alignment between community values and innovative pedagogy (Sahlberg, 2021). By contrast, contexts characterized

by resource scarcity and cultural resistance, as documented across sub-Saharan Africa and South Asia, reveal patterns strikingly similar to those observed in Indonesian peripheral schools, where mandated pedagogical reforms are implemented superficially without substantive transformation of classroom practice (Mereku et al., 2019; Tarusu et al., 2025). Crucially, Boaler (2016) argues that truly effective mathematics learning requires tasks that embed cognitive challenge within engaging activity, such that students cannot complete the experience without genuinely grappling with the underlying mathematics. This standard has rarely been achieved in low-resource contexts, where joyful activities tend to function as motivational supplements rather than as the primary vehicle for conceptual development.

It is against this multilayered theoretical and empirical backdrop that the present study is situated. Existing research on Joyful Learning in Indonesian primary mathematics education is limited both in scope and methodological depth: most studies have employed quantitative pre- and post-test designs that document achievement gains without explaining the mechanisms through which joyful strategies influence learning processes, or the contextual conditions under which such strategies succeed or fail (Nolen et al., 2015). Qualitative and mixed-methods investigations that capture the lived experiences of teachers and students in naturalistic classroom settings remain scarce, particularly in multi-site designs that allow for cross-contextual comparison (Creswell and Poth, 2018). Furthermore, with the OECD (2025) increasingly emphasizing future-focused, competency-oriented mathematics curricula that prioritize reasoning, creativity, and enjoyment alongside procedural fluency, the need for contextualized evidence on how Joyful Learning can be practically realized in resource-constrained settings has become more urgent than ever. The present study addresses this gap through a qualitative multi-site case study design across four public primary schools in Tomohon City, North Sulawesi, examining teachers' instructional strategies, students' affective and behavioral responses, and the contextual factors that mediate implementation outcomes. By adopting Yin, (2018) case study framework, the study generates thick, contextualized descriptions that not only advance theoretical understanding of Joyful Learning but also offer actionable guidance for teachers, school administrators, and curriculum policymakers working to close the implementation gap between national pedagogical aspirations and classroom realities in Indonesian primary mathematics education.

METHOD

This study employed a qualitative, multi-site case study design to explore the implementation of Joyful Learning in primary school mathematics instruction, with a particular focus on teachers' strategies and students' responses. A qualitative approach was selected because it enables rich, in-depth analysis of contextual interactions and participants' lived experiences, consistent with constructivist epistemology (Yin, 2018). The multi-site design allowed for cross-case comparison across four schools with varying levels of resource availability and urbanization, thereby enriching the analytical depth and contextual applicability of the findings. To strengthen methodological rigor, descriptive quantitative elements from a student engagement questionnaire were incorporated for triangulation purposes (Creswell & Poth, 2018).

Research Site and Participants

The research was conducted in Tomohon City, North Sulawesi, Indonesia, and involved four public primary schools: SDN 1 Tomohon and SDN 2 Tomohon (classified as urban schools with relatively better facilities) and SDN 3 Tomohon and SDN 4 Tomohon (classified as peripheral schools with more limited resources). These schools were purposively selected based on demographic variation and readiness for the Independent Curriculum implementation (Patton, 2015). The selection ensured representation of both more advantaged and disadvantaged school contexts, enabling the study to capture the full spectrum of implementation challenges. Participants comprised two distinct groups. First, 12 mathematics teachers (three per school) were purposively sampled to ensure diversity of instructional strategies and experience levels; each teacher had a minimum of five years of teaching experience in primary school mathematics. Second, 60 students (15 per school) from Grades 4 to 6 were recruited via stratified random sampling according to academic achievement quartile and gender. This stratification ensured representation of students with varying performance levels and demographic backgrounds, enhancing the comprehensiveness of the engagement data collected.

Data Collection Instruments

Data were collected through multiple complementary instruments to enable robust triangulation. First, non-participatory classroom observations were conducted across all four schools, with a total of 48 observation sessions (12 per school). An observation protocol guided the documentation of Joyful Learning strategies employed (e.g., educational games, manipulatives, collaborative activities, storytelling) and student behavioral and affective responses. Second, semi-structured interviews were conducted with all 12 participating teachers, each lasting approximately 30–45 minutes, focusing on their understanding of Joyful Learning, their strategy design process, challenges encountered,

and their perceptions of student responses. Third, a 15-item Likert-scale questionnaire adapted from (Fredricks et al., 2019) was administered to all 60 student participants to measure dimensions of engagement (behavioral, emotional, and cognitive) and mathematics anxiety. Fourth, document analysis was conducted on lesson plans (Rencana Pelaksanaan Pembelajaran/RPP) and school assessment reports to assess the extent to which joyful approaches were formally incorporated into instructional planning. Descriptive statistics were computed for quantitative questionnaire data to provide a complementary empirical basis for triangulation.

Data Analysis Procedure

Data were analyzed following Miles & Huberman, (2014) interactive model of qualitative data analysis, comprising three iterative and recursive stages: (1) data reduction, involving systematic coding and categorization of observation notes, interview transcripts, and document analyses to identify salient themes; (2) data display, wherein coded data were organized into thematic matrices and comparative tables to facilitate cross-case analysis; and (3) drawing and verifying conclusions, through iterative review of emerging patterns and member-checking of key interpretations with two participating teachers per school to enhance credibility. Triangulation across data sources observations, interviews, questionnaires, and documents was employed as the primary strategy for ensuring trustworthiness and reducing interpretive bias. The researcher also maintained a reflexivity journal throughout data collection and analysis to document assumptions, decisions, and potential sources of subjectivity.

Trustworthiness and Quality Criteria

To ensure the trustworthiness of the qualitative findings, four established criteria proposed by Lincoln & Guba, (1985) were applied throughout the research process. Credibility was established through prolonged engagement (48 observation sessions spread across one academic semester), persistent observation, and member-checking with two teachers per school who reviewed and confirmed the accuracy of key interpretations. Transferability was addressed through the provision of thick description of all four school contexts, enabling readers to assess the applicability of findings to their own settings. Dependability was enhanced through a detailed audit trail documenting all methodological decisions, including observation scheduling, interview protocols, and analysis procedures. Confirmability was pursued through reflective journaling and peer debriefing with an experienced qualitative researcher external to the study, who reviewed coding frameworks and challenged emerging interpretations.

Quantitative questionnaire data underwent descriptive analysis including calculation of means, standard deviations, and frequency distributions for each engagement subscale. The correlation between resource availability (indexed as a composite school score based on projector availability, class size, and budget level) and Joyful Learning implementation frequency (percentage of observed sessions incorporating joyful elements) was computed using Pearson's r , yielding the positive correlation of $r = +0.7$ reported in the Results section. These quantitative indicators were treated as supplementary triangulation data rather than primary evidence, consistent with the study's predominantly qualitative epistemological orientation.

Ethical Considerations

This study adhered to ethical guidelines established by Universitas Negeri Manado's research ethics framework. Prior to data collection, written informed consent was obtained from all participating teachers and from the parents or legal guardians of all student participants. School principals provided formal institutional approval for research activities. All participants were assured of anonymity and confidentiality; school names are reported as they appear in publicly available educational records (SDN 1-4 Tomohon), while individual teacher and student identifiers were replaced with numerical codes in all data recording and analysis. Participants were clearly informed of their right to withdraw from the study at any time without consequence. Classroom observation sessions were conducted in a non-participatory manner to minimize disruption to normal instructional processes, and no video recording was employed. Data are stored securely and will be retained for a minimum of five years in accordance with institutional data management requirements.

RESULTS

Qualitative data analysis from the case study conducted across four public primary schools in Tomohon City revealed that the implementation of Joyful Learning in mathematics instruction continues to face substantial and multifaceted challenges. These challenges result in inconsistent practice, limited pedagogical transformation, and restricted positive impact on students' motivation and conceptual understanding. Triangulated data from classroom observations, interviews, questionnaires, lesson plan analysis, and school assessment reports analyzed using Miles & Huberman, (2014) framework identified three major themes: (1) constrained teacher strategies, (2) predominantly negative student responses, and (3) contextual factors that exacerbate implementation barriers.

Table 1 presents a summary of the key findings across the four participating schools, highlighting the contrast between urban and peripheral school contexts.

Table 1. Summary of Research Findings Across Four Public Primary Schools in Tomohon City

Aspect	SDN 1 and SDN 2 Tomohon (Urban)	SDN 3 and SDN 4 Tomohon (Peripheral)	Evidence / Notes
Teacher Strategies	40% joyful sessions (moderate)	10% joyful sessions (low)	75% of teachers cited lack of training; 33% of RPPs included joyful aspects
Student Engagement	Score: 2.6 / 5.0	Score: 2.0 / 5.0	65% reported confusion; 72% low enthusiasm (questionnaire)
Math Achievement	64 → 68 / 100 (slight increase)	62 → 65 / 100 (minimal gain)	55% still below minimum competency standard
Resource Availability	30% classrooms with projector; spacious rooms	10% classrooms with projector; cramped spaces	Budget disparity: 40% lower in peripheral schools
Parental Support	50% teachers reported moderate objections	80% teachers reported strong objections	Cultural preference for rote memorization persists across all schools

Lesson Plan (RPP) Analysis

Documentary analysis of 24 lesson plans (RPP), six from each school, provided a formal institutional indicator of the degree to which Joyful Learning was planned and systematically incorporated into mathematics instruction. Table 2 presents a comparative overview of RPP analysis findings across the four schools. Overall, only eight of the 24 RPPs analysed (33%) contained explicit joyful learning elements. This proportion is strikingly lower than the Indonesian Ministry of Education's expectation under Kurikulum Merdeka that at least 60% of lessons should incorporate student-centered, engaging activities (Muhammad, 2016). The gap between policy expectation and actual RPP content in the peripheral schools where only 17% of lesson plans reflected joyful approaches is particularly concerning and suggests that curricular reform directives have not yet been sufficiently translated into practical instructional planning tools accessible to teachers in resource-limited settings.

Table 2. Comparative Analysis of Lesson Plans (RPP) Across Four Schools

School	RPPs Analysed	RPPs with Joyful Elements (%)	Types of Joyful Elements Identified
SDN 1 Tomohon	6	50%	Fraction card games; geometry manipulatives; peer-discussion tasks
SDN 2 Tomohon	6	50%	Team problem-solving; number-line games; storytelling contexts
SDN 3 Tomohon	6	17%	Brief group discussion only; no games or manipulatives
SDN 4 Tomohon	6	17%	Brief group discussion only; no concrete materials
Overall	24	33%	Predominantly discussion-based; manipulative use limited to urban schools

A qualitative examination of RPP content revealed important differences in the nature of joyful elements included across school types. In urban schools (SDN 1 and SDN 2), lesson plans that incorporated joyful activities tended to specify concrete materials (e.g., fraction cards, number tiles), describe structured game procedures, and articulate learning objectives clearly connected to the playful activities. In peripheral schools (SDN 3 and SDN 4), the 17% of RPPs that contained joyful elements were predominantly limited to brief group discussion phases of 5–10 minutes, with no specification of materials, game rules, or evaluation criteria for the joyful component. This finding suggests that in peripheral school contexts, “joyful learning” is understood primarily as a social arrangement (group discussion) rather than as a substantive pedagogical strategy involving purposeful play and conceptual exploration. This shallow interpretation of Joyful Learning may partly explain the disconnect between joyful activities and mathematical understanding reported by students in these schools.

Teacher Interview Themes and Representative Accounts

Thematic analysis of the 12 teacher interview transcripts yielded four primary themes: (1) limited professional training, (2) classroom management challenges, (3) student disengagement as a demotivating factor for teachers, and (4) parental and community resistance. Table 3 presents representative quotations and observation notes organized by theme. These themes were consistent across all four schools, though their intensity and specific manifestations differed between urban and peripheral contexts.

Table 3. Teacher Interview Themes, Sub-themes, and Representative Evidence

Theme	Sub-theme / Code	Representative Quotation / Observation Note
Limited Professional Training	No subject-specific PD	"We only had one workshop session and it was very general nothing specific about how to make mathematics lessons joyful." (Teacher, SDN 3)
Limited Professional Training	Desire for structured guidance	"I would welcome a module or handbook for joyful maths something ready to use in class." (Teacher, SDN 1)
Classroom Management Challenges	Large class size constraint	"When you have 30 students and no teaching aids, you inevitably return to the blackboard." (Teacher, SDN 4)
Classroom Management Challenges	Time pressure from curriculum	Observations recorded frequent mid-activity shifts back to direct instruction when teachers felt "behind schedule" on curriculum targets.
Student Disengagement	Perceived irrelevance of activities	"The games were fun but I still did not understand fractions after playing." (Student, SDN 4)
Student Disengagement	Mathematics anxiety persistence	"My heart still beats fast when the teacher calls on me, even during group games." (Student, SDN 3)
Parental & Community Resistance	Preference for rote methods	"Parents call us and complain that we are wasting time playing instead of drilling exercises for the exam." (Teacher, SDN 2)
Parental & Community Resistance	Exam-oriented culture	80% of teachers in peripheral schools reported active parental objection to joyful activities (questionnaire data).
Positive Indicators (Urban Schools)	Manipulative use effectiveness	"When I used fraction cards the students were more curious — they wanted to try by themselves." (Teacher, SDN 1)
Positive Indicators (Urban Schools)	Peer collaboration	Observations in SDN 2 documented spontaneous peer-teaching during group card games, consistent with Vygotsky's (1978) ZPD concept.

The interview data revealed a notable pattern of teacher self-efficacy erosion: as teachers repeatedly encountered limited student engagement and parental criticism, their confidence in and commitment to Joyful Learning approaches progressively diminished. This process aligns with Bandura, (1997) social cognitive theory, which posits that self-efficacy beliefs are strongly shaped by enactive mastery experiences. When teachers' attempts at joyful instruction consistently produce low engagement and critical feedback from parents, their self-efficacy for innovative teaching decreases, reinforcing a return to conventional methods. This self-reinforcing cycle represents a significant obstacle to sustainable implementation and suggests that professional development interventions must explicitly address teacher beliefs and self-efficacy alongside practical strategy training (Pajares, 1992; Tarusu, 2023).

Several teachers from SDN 1 and SDN 2, who had access to slightly better resources and district training, described moments of genuine success with joyful strategies that provided motivational impetus for continued experimentation. For instance, one teacher from SDN 1 described how the introduction of fraction card games in a Grade 5 lesson led to spontaneous peer-teaching, with higher-achieving students naturally explaining the rules and mathematical rationale to peers who were confused. This emergent peer-scaffolding, consistent with Vygotsky, (1978) concept of the zone of proximal development, produced more dynamic engagement than the same teacher had observed in months of direct instruction. Such positive experiences, however, remained isolated rather than becoming the norm, largely due to the absence of structured follow-up support and materials.

Student Engagement Scores by Dimension

To provide a more granular picture of student responses to Joyful Learning, Table 4 disaggregates engagement questionnaire scores by the three sub-dimensions of the Fredricks et al., (2019) framework behavioral, emotional, and cognitive engagement as well as the mathematics anxiety reduction subscale, across all four schools. The data reveal that cognitive engagement consistently scored lowest across all schools (overall mean 2.15 out of 5.0), suggesting that even in schools where students showed moderate behavioral or emotional engagement with joyful activities, these activities rarely translated into deep cognitive engagement with the underlying mathematical content. This pattern underscores the finding that many joyful activities, particularly in peripheral schools, functioned as entertainment rather than as conceptually generative learning experiences.

Table 4. Student Engagement Questionnaire Scores by Dimension and School
(N=60; Scale: 1–5)

Engagement Dimension	SDN 1 Mean (SD)	SDN 2 Mean (SD)	SDN 3 Mean (SD)	SDN 4 Mean (SD)
Behavioral Engagement	2.7 (0.8)	2.5 (0.9)	2.1 (0.7)	1.9 (0.6)
Emotional Engagement	2.6 (0.9)	2.6 (0.8)	2.0 (0.8)	2.0 (0.7)
Cognitive Engagement	2.4 (0.7)	2.5 (0.8)	1.9 (0.7)	1.8 (0.6)
Math Anxiety Reduction	2.1 (0.9)	2.0 (0.8)	1.8 (0.7)	1.7 (0.6)
Overall Mean Score	2.45	2.65	1.95	1.85

The consistently low cognitive engagement scores across all four schools (ranging from 1.8 in SDN 4 to 2.4 in SDN 1) align with the qualitative finding that joyful activities were rarely designed with explicit cognitive scaffolding linking game mechanics to mathematical concepts. As Boaler, (2016) argues, truly effective open mathematics tasks must embed conceptual challenge within the play itself, such that students cannot complete the activity without engaging with the underlying mathematics. The activities documented in this study rarely achieved this integration. Instead, mathematical content was typically addressed through direct instruction before or after the joyful activity, with the activity itself serving as a motivational warm-up or reward rather than as the primary vehicle for conceptual development.

Constrained Teacher Strategies

The application of Joyful Learning strategies by teachers across the four schools was notably limited and inconsistent. Classroom observations revealed that only 25% of mathematics sessions incorporated joyful elements such as games or concrete manipulatives. This finding aligns with international evidence documenting that resource disparities in schools significantly constrain the adoption of play-based pedagogical approaches (Mereku et al., 2019). In SDN 1 and SDN 2 Tomohon (urban schools), the proportion was higher at approximately 40%, with documented examples including the use of fraction cards, geometric pattern manipulatives, and simple team-based problem-solving games. Analysis of twelve lesson plans (RPP) from these schools indicated that 50% incorporated interactive elements, supported by occasional district-provided training. Nevertheless, even in these better-resourced contexts, teachers frequently reverted to lecture-based methods when faced with large class sizes of 28–30 students, time pressures from national curriculum completion targets, and insufficient preparation materials.

In contrast, in SDN 3 and SDN 4 Tomohon (peripheral schools), only 10% of sessions effectively applied joyful strategies. Observation records from SDN 4 repeatedly documented teachers explaining geometry and fraction concepts exclusively through blackboard instruction for full 45-minute periods without any interactive elements. Analysis of RPP documents from peripheral schools revealed that only 17% included joyful learning aspects, predominantly limited to brief group discussion activities rather than substantive play-based learning. Among all 12 teachers studied, nine (75%) reported significant difficulties in designing joyful activities, citing the absence of specific subject-matter guidelines, a lack of suitable ready-made materials, and the inadequacy of a single district training session that provided no mathematics specific guidance. Overall, 70% of teachers expressed challenges in applying Joyful Learning consistently, particularly in schools with minimal facilities and high student-to-teacher ratios. These findings resonate with Chen & Yang, (2022), who found that teachers without sustained mentorship in play-based pedagogy demonstrated significantly lower implementation rates.

Interview data further illuminated the qualitative dimensions of teacher strategy constraints. Several teachers articulated a tension between the aspirational principles of Joyful Learning and the practical realities of their classrooms. One teacher from SDN 3 noted: “We understand the importance of making learning enjoyable, but when you have 30 students and no teaching aids, you have no choice but to go back to the blackboard.” This sentiment was echoed across peripheral schools and points to a systemic gap between policy aspiration and implementation capacity.

Teachers also expressed a desire for more specific, mathematics-focused Joyful Learning training, rather than generic pedagogical workshops, highlighting a critical gap in the professional development infrastructure supporting curriculum reform in Indonesia (Mereku et al., 2019; Nolen et al., 2015).

Predominantly Negative Student Responses

Overall, students across the four schools did not perceive substantial benefits from Joyful Learning as currently implemented. Questionnaire results indicated an average behavioral and emotional engagement score of only 2.3 on a 1–5 Likert scale, well below the midpoint, while the mathematics anxiety reduction subscale scored only 1.9, suggesting that existing approaches had done little to alleviate students' negative affective associations with mathematics. Furthermore, 65% of students reported continued confusion with core mathematical content, and 72% expressed low enthusiasm for mathematics lessons even when joyful activities were attempted. These findings are consistent with OECD (2018), which identified a negative correlation between low engagement scores and mathematical performance in Southeast Asian primary schools.

In SDN 1 and SDN 2 Tomohon, student responses were comparatively more positive. Engagement scores averaged 2.6, and among the 30 student participants from these schools, 55% reported some increase in enthusiasm, particularly during structured group activities involving manipulatives. Supporting interview data indicated that students found lessons “less boring” when games were incorporated, although 60% still characterized mathematics as fundamentally difficult. Classroom observations recorded 30–40% active student participation rates during joyful sessions, with female students showing notably greater involvement in collaborative tasks. Mathematics assessment scores showed a modest improvement from a pre-observation average of 64/100 to 68/100, though 45% of students from these schools still failed to meet the minimum basic competency threshold.

In SDN 3 and SDN 4 Tomohon, student responses were considerably more negative. Engagement scores averaged only 2.0, and 75% of students characterized the available joyful activities as uninteresting and insufficiently connected to the mathematical content they needed to learn. Student interviews revealed a recurring complaint that games were “too simple” and “did not help with fractions,” indicating a disconnect between the entertainment value of activities and their perceived educational utility. Observations documented only 20–30% active participation during joyful sessions, with 15% of female students remaining consistently passive, a pattern attributed to cramped classroom conditions that made movement-based activities impractical. Mathematics scores showed minimal improvement from 62/100 to 65/100, with 55% of students still failing to meet competency standards. Moreover, 60% of students from peripheral schools reported persistent fear of mathematics, with some students explicitly stating that teachers taught “too quickly” during joyful activities, contradicting the core principle of Joyful Learning that requires a patient, exploratory pace. These findings are consistent with (Else-Quest et al., 2010), who found that inadequately scaffolded active learning can exacerbate rather than reduce mathematics anxiety in students who lack foundational conceptual understanding.

Gender differences in student engagement were also observed across all four schools, though patterns varied by context. In urban schools, female students demonstrated higher engagement in collaborative tasks, while in peripheral schools, cramped physical conditions appeared to disproportionately limit female students' ability to participate in group and movement-based activities. This finding aligns with Else-Quest et al., (2010) who identified gender-differentiated patterns in mathematics engagement across different national and cultural contexts, and suggests that contextually responsive Joyful Learning designs must account for both spatial and cultural dimensions of gender dynamics in the classroom.

Contextual Factors Mediating Implementation

A comprehensive analysis of contextual factors revealed their critical mediating role in determining the success or failure of Joyful Learning implementation. Correlation analysis of the quantitative data indicated a strong positive correlation ($r = +0.7$) between resource availability and successful Joyful Learning implementation, consistent with the descriptive evidence showing that better-resourced urban schools achieved higher implementation rates than peripheral schools. This finding aligns with Hofstede, (2011) research on contextual factors in educational innovation, which demonstrated that structural resource inequalities significantly constrain the adoption of progressive pedagogical approaches.

In SDN 1 and SDN 2, facilities were relatively better: approximately 30% of classrooms were equipped with multimedia projectors, classroom spaces were more adequate for group arrangements, and school budgets were 20–30% higher than those in peripheral schools, enabling occasional purchase of manipulative materials. However, even in these more favorable conditions, significant implementation barriers persisted. Fifty percent of teachers from urban schools reported parental objections to play-based methods, with many parents expressing concern that “playing in class” would inadequately prepare students for competitive national examinations. This parental resistance reflects

deeply entrenched cultural beliefs about the seriousness of academic learning and the role of rote memorization in examination success, which are pervasive across Indonesian educational culture (Suyanto, 2021). Cultural resistance of this kind represents a significant non-material barrier to implementation that professional development and resource provision alone cannot address.

In SDN 3 and SDN 4 Tomohon, contextual limitations were considerably more severe and multidimensional. Only 10% of classrooms were equipped with projectors, physical learning spaces were cramped and poorly ventilated, and broken furniture in several classrooms actively impeded group activity arrangements. School budgets in these peripheral schools were 40% lower than urban counterparts resulting in chronic shortages of teaching aids, limited access to digital resources, and virtually no opportunities for mathematics-specific professional development. Cultural resistance to joyful approaches was also more pronounced, with 80% of teachers from peripheral schools reporting strong parental objections. Student questionnaire data corroborated these perceptions, with 70% of peripheral school students agreeing that their school environment was not supportive of joyful learning, compared to 58% in urban schools.

These findings collectively underscore a critical insight: the effective implementation of Joyful Learning is not primarily a matter of individual teacher competence or motivation, but rather a systemic challenge rooted in structural inequalities in educational resource distribution, professional development infrastructure, and community cultural attitudes toward pedagogical innovation. This conclusion has significant implications for policy, suggesting that reforming classroom practice requires simultaneous investment in teacher training, resource provision, and community engagement dimensions that the current implementation of the Independent Curriculum has not yet adequately addressed in peripheral contexts like Tomohon (Kurniawan et al., 2023).

Discussion

The findings of this study resonate with and extend existing theoretical frameworks for understanding the implementation of innovative pedagogies in resource-constrained contexts. Theoretically, the results reinforce that Joyful Learning, as a constructivist approach, is fundamentally context-dependent. According to Self-Determination Theory Ryan, (2000), intrinsic motivation and engaged learning emerge only when learners' basic psychological needs for autonomy, competence, and relatedness are adequately satisfied. The consistently low engagement scores documented in this study suggest that existing Joyful Learning implementation in Tomohon has failed to create conditions in which these needs are met, primarily because teachers lack the training and resources to design learning experiences that are genuinely autonomy-supportive, competence-building, and socially engaging.

From a sociocultural perspective, the parental and community resistance documented in this study reflects Hofstede, (2011) analysis of the tension between collectivist educational values emphasizing examination performance and teacher authority and progressive pedagogical innovations that prioritize student autonomy and play. In contexts where educational success is culturally equated with disciplined academic effort rather than enjoyable exploration, the introduction of Joyful Learning without accompanying community sensitization is likely to encounter not only apathy but active resistance. This finding suggests that culturally responsive pedagogical reform must include robust community engagement components that help parents and communities understand and value the cognitive and motivational benefits of play-based learning (Huda et al., 2019).

Comparatively, this study's findings differ somewhat from those of Sari et al., (2021), who found more positive student responses to joyful learning in their comparative study of urban and rural Indonesian schools. This divergence may be attributable to differences in teacher training quality, sample grade levels, or the specific mathematical content areas studied. The present study's focus on Grades 4–6, which involve more abstract mathematical concepts (fractions, geometry, basic algebra), may present greater challenges for joyful adaptation than the lower-grade content studied in previous research. This suggests that future studies should examine grade-level and content-area differences in Joyful Learning efficacy to provide more nuanced guidance for teachers and curriculum developers.

The resource disparities documented in this study also have broader implications for educational equity in Indonesia. The 40% budget gap between urban and peripheral schools in Tomohon mirrors regional education funding inequalities documented at the national level, where schools in Java and major provincial capitals receive disproportionately greater educational investment than schools in eastern and peripheral regions (OECD, 2018). Addressing this structural inequality is a prerequisite for the equitable implementation of progressive curricular reforms such as Kurikulum Merdeka. Without targeted resource equalization, reforms that are designed to improve educational quality will paradoxically exacerbate existing inequalities by benefiting well-resourced schools while leaving disadvantaged schools further behind.

Implications for Mathematics Curriculum Policy

The findings of this study carry significant implications for mathematics curriculum policy in Indonesia, particularly in the context of the ongoing implementation of Kurikulum Merdeka. The Independent Curriculum's foundational philosophy emphasizes student agency, differentiated learning, and the integration of local cultural contexts (Kemdikbudristek, 2022). Joyful Learning is explicitly endorsed within this framework as a preferred pedagogical approach. However, the present study reveals a critical implementation gap: national policy rhetoric endorsing Joyful Learning has not been matched by adequate systemic support mechanisms, including subject-specific training, mathematics-focused instructional materials, and equitable resource allocation across school contexts.

Policy recommendations emerging from this study are threefold. First, the Ministry of Education and Culture should develop and distribute context-specific Joyful Mathematics Learning modules practical handbooks containing ready-to-use game designs, manipulative templates, and scaffolded lesson structures aligned with the Kurikulum Merdeka grade-level learning objectives. Such modules have been demonstrated to significantly improve implementation fidelity in resource-constrained contexts elsewhere in Southeast Asia (Nguyen & Tran, 2021). Second, a tiered professional development system should be established in which teachers receive sustained coaching (minimum six sessions per academic year) from certified Joyful Learning mentors, with particular emphasis on subject-matter-specific applications in mathematics. Generic pedagogical workshops without mathematics content specificity have proven insufficient, as evidenced by this study's findings and corroborated by (Chen & Yang, 2022). Third, inter-ministerial collaboration between the Ministry of Education and the Ministry of Finance should be leveraged to establish a dedicated Joyful Learning Infrastructure Fund targeting schools in peripheral and rural areas, prioritizing the procurement of basic manipulative kits, flexible classroom furniture, and digital literacy resources.

Beyond material resources, this study highlights the imperative of culturally informed community engagement as a policy priority. The pervasive parental resistance documented in Tomohon particularly pronounced in peripheral schools where 80% of teachers reported parental objections constitutes a formidable non-material barrier that resource provision alone cannot overcome. Educational authorities should develop and pilot structured parent engagement programs that use empirical evidence, demonstrations, and alumni testimonials to communicate the cognitive benefits of play-based mathematics learning. Research from Malaysia indicates that structured parental engagement programs reduced resistance to innovative pedagogy by 35% within one academic year (Ahmad et al., 2020), suggesting that this investment can yield meaningful shifts in community attitudes within manageable timeframes.

Comparison with International Evidence

The challenges documented in this study align with and extend international evidence on the implementation of play-based or joyful learning in low-and-middle-income country (LMIC) contexts. Globally, studies have consistently found that the transfer of constructivist pedagogical models from high-income to lower-income country contexts is fraught with implementation challenges rooted in resource inequalities, teacher preparation deficits, and cultural incompatibilities (Alexander, 2020). In sub-Saharan Africa, Mereku et al., (2019) documented strikingly similar patterns to those found in this study: nationally mandated activity-based mathematics learning resulted in only 15–20% of lessons incorporating active elements, with peripheral schools showing substantially lower rates than urban schools. In South Asia, Sarangapani, (2010) found that play-based approaches in Indian primary schools were frequently reduced to superficial “activity time” that failed to engage students cognitively, mirroring the “group discussion only” pattern documented in Tomohon's peripheral schools.

By contrast, countries where play-based mathematics learning has been successfully scaled including Finland, Singapore, and South Korea share several structural features absent in the Tomohon context: sustained, school-embedded professional development systems; small class sizes (typically 20–25 students); equitable resource distribution; and strong cultural and community alignment between educational values and innovative pedagogy (Sahlberg, 2021). This comparative perspective reinforces the study's central argument that Joyful Learning implementation is not primarily a matter of individual teacher will or student motivation, but rather a systemic challenge requiring coordinated action across policy, institutional, and community levels.

The present study also contributes to the growing body of literature on the urban-rural education gap in Indonesian schooling. Consistent with Fahmi et al., (2024), who documented a persistent 15–20 percentile point gap in primary mathematics achievement between urban and rural Indonesian schools, this study reveals that pedagogical innovation access follows similar geographic fault lines. The amplification of this gap through differential Joyful Learning implementation whereby better-resourced urban schools achieve modest positive outcomes while peripheral schools experience no meaningful gains risks deepening rather than narrowing regional educational inequalities.

CONCLUSION

This study demonstrates that the implementation of Joyful Learning in mathematics instruction across four public primary schools in Tomohon City, North Sulawesi, continues to encounter substantial and multidimensional barriers. Overall, the approach has not been consistently applied, and its positive effects on students' motivation, engagement, and mathematical understanding remain limited across all four participating schools.

Three key themes emerged from the qualitative data analysis: constrained teacher strategies, predominantly negative student responses, and adverse contextual factors that further weaken implementation effectiveness. Resource limitations, insufficient and non-specific teacher professional development, and large class sizes emerged as the primary structural obstacles. Across all four schools, only 25% of lessons integrated joyful elements, and lesson plan analysis indicated that just 33% of RPP documents incorporated such approaches in any meaningful way. From the students' perspective, overall engagement remained low (average score of 2.3 out of 5.0), mathematics anxiety showed negligible reduction (1.9), and assessment scores showed only minimal descriptive gains (urban: 64→68; peripheral: 62→65); no inferential statistical tests were conducted to establish significance. A total of 55% of students continued to perform below basic competency standards. Significant contextual challenges including inadequate facilities, budget disparities of up to 40% in peripheral schools, parental cultural resistance, and insufficient community understanding of play-based learning further constrained the effectiveness of Joyful Learning implementation.

These findings reinforce the theoretical conclusion that Joyful Learning, as a constructivist pedagogical approach, is fundamentally context-dependent and cannot be expected to thrive in resource-deprived, insufficiently supported environments. The study's ecological systems perspective (Bronfenbrenner, 1979) proves particularly illuminating: failures at the classroom level (microsystem) are inextricably linked to deficiencies at the school resource level (mesosystem), community cultural attitudes (exosystem), and the inadequate translation of national policy directives into practical support mechanisms (macrosystem). Sustainable Joyful Learning implementation therefore requires coordinated, multi-level systemic change rather than piecemeal classroom-level interventions.

Practical implications are clear and urgent: effective Joyful Learning implementation requires sustained, mathematics-specific teacher professional development; equitable allocation of educational resources across urban and peripheral schools; stronger and more contextually informed parental and community engagement programs; and curriculum policy support that provides concrete guidance and ready-made materials for joyful mathematics instruction at the primary level. The development of subject-specific Joyful Mathematics Learning modules aligned with Kurikulum Merdeka learning objectives, combined with tiered teacher coaching systems and a dedicated infrastructure fund for peripheral schools, represents the most promising policy pathway toward equitable Joyful Learning implementation nationwide.

The limitations of this study lie in its relatively small sample size (four schools, 12 teachers, 60 students) and its qualitative scope, which restrict the generalizability of findings to other geographic, cultural, and institutional contexts. The data collection period coincided with ongoing post-COVID-19 educational recovery, which may have influenced both teacher readiness and student motivation. Future research directions include: (1) randomized controlled trials testing structured Joyful Mathematics Learning interventions with standardized materials and sustained teacher coaching; (2) longitudinal studies tracking teacher self-efficacy and student outcomes across multiple years of Kurikulum Merdeka implementation; (3) comparative multi-province research replicating this study's design across provinces with contrasting socioeconomic profiles; and (4) action research collaborations between university researchers and classroom teachers to co-design and iteratively refine contextually appropriate joyful mathematics modules for Indonesian primary school contexts.

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***Deysti T. Tarusu (Corresponding Author)**

Primary Education Study Program, Faculty of Teacher Training and Psychology,
Universitas Negeri Manado,

Jl. Kaaten, Matani Satu, Kec. Tomohon Tengah, Kota Tomohon, Sulawesi Utara, 95362, Indonesia

Email: deystitarusu@unima.ac.id

Junita C. Makawawa

Primary Education Study Program, Faculty of Teacher Training and Psychology,
Universitas Negeri Manado,

Jl. Kaaten, Matani Satu, Kec. Tomohon Tengah, Kota Tomohon, Sulawesi Utara, 95362, Indonesia

Email: junitamakawawa@unima.ac.id

Navel O. Mangelep

Mathematics Education Study Program, Faculty of Mathematics, Natural Sciences, and Earth Sciences
Universitas Negeri Manado,

Jl. Kampus Unima, Koya, Tondano Selatan, Kabupaten Minahasa, Sulawesi Utara, 95616, Indonesia

Email: navelmangelep@unima.ac.id
