



Needs Analysis for Developing ROLL-PAJA Learning Media to Support SPO Sentence Writing in Grade II Elementary School

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ABSTRACT

This study aimed to analyze the needs for developing ROLL-PAJA learning media to improve students' ability to construct SPO sentences. This research employed a qualitative descriptive approach with a case study design, involving 1 Grade II classroom teacher and 10 Grade II students at SDN 3 Sedayulawas as data sources. Data were collected through observation, interviews, and documentation. The findings revealed that students remained passive during instruction, struggled to visualize SPO sentence structure without concrete aids, relied solely on textbook exercises with no hands-on practice, and showed low engagement due to the absence of interactive activities. Interviews further identified students' need for kinetic interactivity, contextual learning, differentiated support, and operational flexibility. Based on these findings, ROLL-PAJA was designed with four integrated components: a rolling ball, an SPO board, fictional snacks, and a color-coding system to distinguish each sentence element visually. In conclusion, ROLL-PAJA contributes a practical and evidence-based learning media prototype that supports active and differentiated Indonesian language learning at the elementary level, and can serve as a replicable model for developing interactive media aligned with the Merdeka Curriculum framework.

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1. INTRODUCTION

The implementation of the Merdeka Curriculum in Indonesia has brought significant transformation to the national education landscape. This curriculum philosophically emphasizes creative thinking, freedom, student independence, and the creation of an active, meaningful, and student-centered learning ecosystem. Angga et al. (2023) affirm that the Merdeka Curriculum is explicitly designed to develop the Pancasila student profile through contextual and relevant learning approaches, granting autonomy to teachers and educational institutions to innovate in their pedagogical practices, so that the learning process is no longer confined to rigid and uniform patterns. This transformation demands that teachers not only deliver content but also design meaningful, challenging, and individually responsive learning experiences.

In the context of Indonesian language learning, Samiha et al. (2023) state that the four language skills—listening, speaking, reading, and writing—are the main pillars that must be integrated into every learning design; however, the reality in the field shows that many teachers still rely on theoretical and rote learning techniques, causing learning activities to proceed stiffly, monotonously, and with little meaning for students. This concern is supported by empirical evidence at the national level. Maharani and Wahidin (2022), through a study examining the literacy competency of elementary school students using the Minimum Competency Assessment (AKM) framework, found that the majority of students were categorized at the basic level, with most unable to reach the expected cognitive levels in reading literacy — including the ability to find information, develop understanding, and evaluate text content. This finding is consistent with Hafizha and Rakhmania (2024), who reported that the implementation of literacy strengthening programs in elementary schools has not yet produced significant improvement in AKM literacy outcomes, indicating that foundational literacy weaknesses persist systematically across schools in Indonesia. At the level of writing competency specifically, Puspawati et al. (2022) found that elementary school students demonstrated persistent errors across all basic sentence structure components — including subject, predicate, and object indicators — in their written outputs, confirming that the mastery of sentence structure remains a critical and unresolved challenge in Indonesian elementary education. This condition emphasizes that early-level writing and language structure skills are not merely curriculum targets but critical foundations that determine student literacy success in the future. Without a strong grasp of basic sentence structure from an early age, students will experience cumulative difficulties in expressing ideas in writing at higher educational levels.

One of the basic competencies that second-grade elementary school students must master is the ability to compose sentences following the Subject-Predicate-Object (SPO) pattern. This ability encompasses the cognitive skill of organizing words into a coherent, logical, and communicative whole. This constructive process cannot be completed through mere verbal instruction from the teacher. Nurmalasari (2023) empirically found that lower-grade students still struggle with all aspects of language skills, including writing and combining words into correctly structured sentences; the primary causes are learning methods ill-suited to students' developmental characteristics and the absence of contextual and concrete learning media. This is compounded by Ahmad and Mustika (2021), who found that many teachers experience difficulties in selecting, developing, and operating media capable of bridging abstract content with students' real experiences. Thus, the gap between SPO competency targets and students' actual achievement is a systemic problem in the design and implementation of learning media at the lower-grade level.

Psychologically, second-grade elementary school students are in the concrete operational phase. Marinda (2020) affirms that children aged 7–11 are sufficiently mature to think logically, but only with respect to physical objects they can observe, touch, and manipulate directly; abstract concepts including sentence structure are still very difficult to absorb without the aid of concrete representation. Delivering content that relies solely on verbal explanation and textbooks carries a high risk of creating deep-rooted misconceptions in students' linguistic understanding. They tend to show far greater enthusiasm when learning activities are presented in an enjoyable, healthily competitive atmosphere integrated with dynamic game elements (Sari et al., 2021). These characteristics demand a media design approach that is truly aligned with children's cognitive developmental stage and psychological needs.

The theoretical grounding of this study rests on five foundational perspectives that collectively explain why an integrated, game-based, and differentiated media approach is necessary for SPO sentence learning at the lower-grade elementary level. From a developmental standpoint, Piaget's theory of cognitive development establishes that children aged 7–11 occupy the concrete operational stage, wherein logical thinking remains inseparable from the direct manipulation of physical objects (Hayat et al., 2024). This developmental reality means that SPO sentence structure — an inherently abstract grammatical concept — cannot be effectively transmitted through verbal instruction or printed text alone; it requires media that students can physically handle, arrange, and reorganize. Complementing this, Vygotsky's sociocultural theory, particularly the Zone of Proximal Development (ZPD), holds that meaningful learning occurs in the space between what a student can do independently and what they can achieve with guided support (Lei & Bakar, 2025). Applied to SPO learning, this principle demands that instructional media be designed not merely as a content container but as a dynamic scaffold — one that provides graduated structural cues, withdraws support progressively, and positions the teacher or peer as a mediating agent rather than a sole knowledge transmitter.

Bruner's theory of representation further specifies the sequencing logic that effective media must follow. Bruner proposed that learners construct knowledge most durably when instruction moves through three successive modes: enactive (learning through physical action), iconic (learning through visual representation), and symbolic (learning through abstract language) (Arsyad et al., 2024). A media design for SPO learning that begins with a kinetic game mechanic — where students physically move and arrange sentence components — before transitioning to color-coded visual representations of subject, predicate, and object, and only then to the complete written sentence, embodies this enactive-to-symbolic progression precisely. Alongside Bruner, Mayer's Cognitive Theory of Multimedia Learning provides the cognitive architecture for how such media must be engineered (Mayer, 2024) and demonstrates across more than 200 experiments that humans process verbal and visual information through separate cognitive channels, each with limited capacity, and that meaningful learning requires the active integration of both channels simultaneously. For SPO media specifically, this means that color-differentiated visual cues for each sentence component must be presented concurrently with verbal or written labels — not sequentially — so that both channels are engaged without either being overloaded (Mayer, 2024).

The fifth theoretical pillar, Tomlinson's framework of Differentiated Instruction, addresses a dimension that purely cognitive theories leave unresolved: the reality that students in any single classroom bring meaningfully different levels of language readiness, motivation, and

prior experience with sentence structure. Gibbs (2025), extending Tomlinson's framework, argues that instructional effectiveness is determined not only by the quality of content delivery but by the degree to which teaching strategies are aligned with individual learner characteristics — adjusting content, process, and product according to actual student needs. In the context of game-based SPO media, this principle manifests as a motivational reinforcement system that is differentiated rather than uniform, offering feedback and challenge levels calibrated to each student's readiness rather than applying a single standard to all. This theoretical requirement directly informs the design specification for differentiated motivational reinforcement identified in Table 1 as absent from all prior media studies in this domain. Taken together, these five theoretical perspectives converge on a unified set of design imperatives that the present needs analysis seeks to operationalize into concrete media specifications grounded in field data from SDN 3 Sedayulawas Grade II.

International research further corroborates these findings. Alotaibi (2024) demonstrated through a systematic review and meta-analysis that game-based learning produces moderate to large positive effects on cognitive, social, emotional, motivation, and engagement outcomes in early childhood education, affirming its promise as a foundational pedagogical strategy for young learners. At the sentence-structure level specifically, Singgaravi and Ahmad (2022) investigated gamification as an intervention for Year 2 pupils in primary schools. They found that it significantly improved students' ability to write simple S-V-O sentences correctly while creating a fun and engaging learning environment that motivated low-proficiency learners. Beyond gamification, interactive game formats have also proven effective in broader language contexts: Moquerio et al. (2025) confirmed through a quasi-experimental study that interactive sentence-building games significantly enhanced sentence construction skills among Grade 7 learners compared to those receiving conventional grammar instruction. Regarding writing intervention design, Zeng et al. (2024) demonstrated that a comprehensive game-based intervention incorporating multisensory approaches, explicit instruction, and motivating activities at the sub-lexical, lexical, and sentence levels effectively improved writing skills among elementary-age children. With respect to the integration of concrete and manipulative media, Quane (2024) established that concrete materials providing tactile experiences enable students to model, explore, and reflect on abstract concepts, forging meaningful connections between physical experience and conceptual understanding — a finding particularly relevant for young learners who are still developing abstract reasoning capacity.

The gap between ideal conditions and field reality forms the primary background of this research. Indonesian language instruction in elementary schools is still frequently dominated by a teacher-centered approach that positions students as passive, uncritical, and unproductive knowledge receivers (Hutasoit, 2021), directly correlating with low student motivation and learning achievement. As shown in Table 1, previous media innovations have each contributed positively within their respective fields; however, each addresses only one dimension of the learning challenge. A systematic search of Scopus, Google Scholar, and ERIC databases (conducted in January 2026, limited to 2018–2025, yielding 47 results after title and abstract screening) using the terms “SPO sentence media,” “game-based language media elementary,” “rolling ball learning media,” and “differentiated manipulative media Indonesian” yielded no study that integrates kinetic game mechanics, concrete structural visualization, and differentiated motivational reinforcement within the specific context of SPO sentence learning for lower-grade elementary students — confirming the novelty of this integrated approach. To provide a clearer overview of the current state of research and justify

the need for this study, Table 1 summarizes relevant previous studies and identifies the research gap that this study seeks to address.

Table 1. Comparison of prior media studies and the research gap addressed by this study

Researcher	Media/Approach	Finding	Limitation Related to Research Gap
(Puspawati et al., 2022)	Analysis of SPO writing ability	Students frequently made errors in subject, predicate, and object components.	Identified SPO difficulties but did not provide instructional media, game mechanics, or motivational reinforcement
(Singgaravi & Ahmad, 2022)	Gamification for SVO sentence writing	Improved students' sentence construction ability through gamification	Included motivational game elements but lacked concrete SPO visualization and manipulative learning media
(Azami et al., 2021)	Rolling ball media	Increased student engagement and participation	Provided kinetic game mechanics but was not designed for SPO learning and did not include SPO visualization or reinforcement system
(Martiasari & Kelana, 2022)	Manipulative media	Improved conceptual understanding through hands-on activities	Provided concrete learning experiences but did not incorporate game mechanics or motivational reinforcement
(Sabikah et al., 2024)	Rolling ball game	Improved motivation and learning attention	Combined rolling ball and game elements but did not address SPO sentence structure or provide concrete SPO visualization
This Study	Integrated needs analysis	Identifies media requirements for SPO sentence learning	Findings are derived from a single classroom at one coastal school; transferability to other contextual settings requires further investigation

This gap underscores the need for a needs analysis study that systematically identifies the specific media requirements for SPO sentence learning at the lower-grade elementary level. Unlike previous studies that each addressed only a single dimension of the learning challenge, this study offers novelty in the form of an integrated needs analysis that simultaneously examines the requirements for kinetic game mechanics, concrete structural visualization of SPO patterns, and differentiated motivational reinforcement—three elements that a systematic review of the available literature confirms have not been integrated in any single prior study within the context of Indonesian language learning at the lower-grade elementary level. This study therefore aims to conduct an in-depth, field-data-based analysis of the media specifications genuinely needed by teachers and students at SDN 3 Sedayulawas Grade II, to ensure that the media developed will have a strong empirical basis and can serve as a real solution for improving SPO sentence composition ability in the Merdeka Curriculum era.

2. METHODS

This study uses quantitative methods. Quantitative methods are an approach based on empirical philosophy to examine populations or samples using research instruments and data analysis processes using statistical tests to examine predetermined hypotheses (Sugiyono 2024). A quantitative approach was chosen because the researcher aimed to test the effect of the independent variable, namely surah Al-Hujurat–based multicultural learning, on the dependent variable, students' attitudes toward tolerance, using data that are objectively measurable and amenable to statistical analysis.

This study employed a qualitative descriptive approach with a case study design. Khairiyah et al. (2026) affirm that a case study design within educational contexts enables researchers to explore a phenomenon in depth through multiple data sources, capturing the complexity of a specific and bounded situation in its natural setting — particularly appropriate when the aim is to understand how and why a phenomenon occurs rather than how often. This approach was selected because the study aims to describe in depth the objective conditions in the field, analyze the specific challenges encountered in Indonesian language learning on SPO material, and map the underlying factors driving the need for ROLL-PAJA media development, all within the bounded context of a single Grade II classroom at SDN 3 Sedayulawas.

The research subjects consisted of one Grade II classroom teacher and ten Grade II students of SDN 3 Sedayulawas, Brondong District, Lamongan Regency. The ten students represented the entire Grade II class enrollment at the school, and all were directly and actively involved in the Indonesian language learning process. Subject selection was carried out purposively because the characteristics of this class were considered the most contextually relevant and information-rich for exploring the specific media needs addressed in this study. Several interconnected reasons underlie this selection. First, SDN 3 Sedayulawas is located in a coastal area of Brondong District, Lamongan Regency, where the majority of students come from fishing families with limited access to educational resources and learning support at home — a socioeconomic context that directly shapes students' prior literacy exposure and makes the availability of concrete, engaging, and contextually meaningful learning media particularly critical. Second, Grade II at this school is at a pivotal stage of the Merdeka Curriculum implementation, in which teachers are expected to design student-centered and contextually relevant learning experiences; however, field observations indicate that instructional practices in Indonesian language learning remain largely teacher-centered and media-poor, creating a visible and urgent gap between curriculum expectations and classroom reality. Third, preliminary identification revealed that Grade II students at this school demonstrate specific and recurring difficulties in constructing sentences following the SPO pattern in their written outputs, making this class a particularly information-rich case for examining what kinds of media features are genuinely needed to address those difficulties. The convergence of these three factors — coastal socioeconomic context, Merdeka Curriculum implementation challenges, and documented SPO learning difficulties — makes Grade II at SDN 3 Sedayulawas a bounded and contextually representative case for this needs analysis study. This aligns with Dahal et al. (2024), who affirm that in qualitative case study research, participant selection should be driven by the contextual richness and relevance of the case to the research phenomenon, rather than by numerical representation. Accordingly, the relatively small number of participants in this study — one teacher and ten students — reflects a deliberate methodological decision consistent with the bounded case study design, rather than a practical or technical limitation: the unit of analysis is the case itself, and with a single classroom teacher and the full class enrollment of ten students serving as the only participants, all available informant perspectives within the site were captured. Cross-source triangulation across observation, interview, and documentation further confirmed that no new thematic categories emerged beyond those already identified, indicating that data saturation was achieved and that the data set was sufficient to address the study's research questions.

Data collection was conducted through three complementary methods. Chand (2025) explains that integrating observation, interview, and document analysis in qualitative case

study research enables researchers to construct a nuanced and multidimensional picture of the phenomenon by capturing behavioral data, individual perspectives, and contextual evidence simultaneously. First, structured observation was conducted across two learning sessions using a checklist instrument. Second, a semi-structured in-depth interview was conducted with the classroom teacher in one session lasting approximately 30–45 minutes, conducted face-to-face at the school with the teacher's full consent. Ruslin et al. (2022) affirm that the semi-structured interview allows researchers to follow a guided thematic structure while simultaneously probing deeper into responses, making it particularly effective for uncovering in-depth perspectives that structured instruments alone cannot capture. Third, documentation in the form of teacher daily lesson notes, student-written work samples, and other relevant supporting data was used to reinforce and validate field findings. The complete data collection instruments and their indicators are presented in Table 2.

Table 1. Data Collection Techniques, Instruments, and Indicators

Technique	Instrument	Indicators
Observation	Structured observation checklist (2 sessions)	(1) Learning methods used; (2) Presence and type of learning media; (3) SPO structure visualization during learning; (4) Student engagement and psychological responses; (5) Teacher–student interaction patterns.
Interview	Semi-structured interview guide (12 questions, 1 session, ±30–45 minutes)	(1) Teacher's difficulties in teaching SPO sentence structure; (2) Students' common errors in constructing SPO sentences; (3) Learning media currently used and their limitations; (4) Desired features and specifications of learning media; (5) Contextual and motivational factors affecting SPO learning.
Documentation	Document review sheet	(1) Teacher's lesson plans and daily teaching notes; (2) Samples of students' written work on SPO sentence construction; (3) Classroom learning documentation and activity records.

The collected data were analyzed using Miles and Huberman's interactive qualitative data analysis model, comprising three interdependent stages: data reduction, data display, and conclusion drawing. In the data reduction stage, the researcher performed open coding of raw field notes and interview transcripts, systematically identifying recurring patterns and labeling them into initial categories. These initial codes were subsequently grouped into thematic clusters through focused coding, resulting in a structured categorization of media needs across three dimensions: kinetic engagement needs, structural visualization needs, and motivational reinforcement needs. Hanisah et al. (2024), in a comparable needs analysis study for Indonesian language learning media at the elementary level, applied an identical analytical sequence and demonstrated that this three-stage coding process effectively maps media development requirements from qualitative field data systematically and transparently. In the data display stage, the categorized information was compiled in the form of descriptive narratives and analytical tables to facilitate conclusion drawing. In the conclusion drawing stage, inductive interpretation was applied to derive meaning from the categorized data in relation to the study's research questions.

To maintain data validity and credibility, the researcher applied two forms of triangulation. Source triangulation was conducted by cross-checking data obtained from the classroom teacher, ten students, and documentation sources, verifying the consistency of findings across multiple informants. Technique triangulation was conducted by comparing and corroborating data gathered through observation, interview, and documentation, ensuring that convergent findings across all three methods could be considered credible and transferable. Manouilidou et al. (2024), in a triangulation study conducted in elementary school settings, demonstrated that the concurrent application of source and technique triangulation substantially strengthens the trustworthiness of qualitative findings by reducing single-source bias and increasing interpretive depth — a principle directly applied in the present study to ensure that the media needs identified are empirically grounded and contextually valid.

To further strengthen credibility, the researcher's positionality is acknowledged here. The first author is a faculty member at PGRI Ronggolawe University of Tuban who has no formal institutional relationship with SDN 3 Sedayulawas, ensuring structural independence from the research site. To minimize observer bias, field notes were recorded using a standardized checklist instrument without interpretive annotation during observation sessions, and interview data were audio-recorded and transcribed verbatim prior to analysis. Member checking was not conducted in this study, which constitutes a limitation; this was primarily due to time constraints in the data collection phase and limited re-accessibility of the participant following the conclusion of formal fieldwork. However, the cross-source triangulation procedure described above partially mitigates this gap by verifying consistency across independently gathered data sources.

3. RESULTS AND DISCUSSION

3.1 Result

The results of this study are drawn from three complementary data sources collected at SDN 3 Sedayulawas Grade II during February 2026: direct classroom observation across two learning sessions, a semi-structured interview with the Grade II classroom teacher (Ms. Rohmatul Inayah, S.Pd.), and documentation of student written work samples. Each source is presented separately to preserve the integrity of the field data.

3.1.1 Analysis of Classroom Learning Problems

Classroom observation at SDN 3 Sedayulawas revealed a consistent and recurring pattern of difficulties in Indonesian language learning on Subject–Predicate–Object (SPO) material. The school is situated in a coastal area of Brondong District, Lamongan Regency, where students actively use vocabulary shaped by their fishing community environment in daily communication. Although the 10 students demonstrated adequate verbal communication skills in informal contexts, they experienced significant difficulties when required to transform their oral language competence into formal written sentence structures following the Subject–Predicate–Object (SPO) pattern. The detailed findings from both observation sessions, organized according to the five observation checklist indicators, are presented in Table 3.

Table 3. Classroom Observation Results

Indicator	Session 1 (5 February 2026)	Session 2 (12 February 2026)
(1) Learning methods used	Teacher delivered instruction exclusively through verbal explanation; students copied sentence examples from the	The same teacher-centered pattern was observed; instruction remained lecture-

	board; no student-centered or interactive activity was conducted.	based with no variation in delivery method.
(2) Presence and type of learning media	Only a textbook was present; no manipulative aids, word cards, visual boards, or any hands-on instructional materials were available in the classroom.	Identical condition confirmed; the classroom contained no learning media other than the textbook and board.
(3) SPO structure visualization during learning	No visual representation of SPO structure was provided; the teacher explained sentence patterns verbally without any structural diagram, color coding, or positional aid.	Same condition observed; students had no visual reference for SPO positioning during the writing task.
(4) Student engagement and psychological responses	A majority of students appeared disengaged — looking outside the classroom, losing concentration, and participating minimally during sentence-construction tasks	The same disengagement pattern persisted; students responded passively to teacher prompts and showed low motivation during written exercises
(5) Teacher-student interaction patterns	Interaction was one-directional; the teacher explained, and students copied; no dialogue, peer activity, or manipulative interaction was initiated.	The same unidirectional pattern was maintained; when students made errors, the teacher re-explained verbally without introducing any structural or visual corrective aid.

3.1.2 Identification of Strategic Needs According to the Teacher

The near-identical findings across both observation sessions, rather than being a limitation, serve an important methodological function: they confirm the stability and consistency of the observed instructional patterns across time. The replication of identical conditions across two independent sessions conducted one week apart (5 and 12 February 2026) substantially strengthens the claim that the patterns identified — teacher-centered instruction, absence of media, no SPO visualization, low student engagement, and unidirectional interaction — represent stable structural features of this classroom's learning environment rather than isolated or context-specific events.

A semi-structured in-depth interview was conducted with one participant (T1), Ms. Rohmatul Inayah, S.Pd., the Grade II classroom teacher at SDN 3 Sedayulawas, to validate and enrich the classroom observation findings. The interview explored the teacher's experiences in teaching Subject–Predicate–Object (SPO) sentence construction, the learning difficulties encountered by students, the limitations of the instructional media currently used, and the characteristics of learning media considered effective for supporting SPO instruction. In addition, the interview examined contextual and motivational factors influencing students' participation during learning activities. Analysis of the interview data resulted in four major themes: (1) students' structural difficulties in SPO sentence construction, (2) limitations of existing learning media, (3) desired characteristics of learning media, and (4) contextual and motivational factors affecting learning.

Students' Structural Difficulties in SPO Sentence Construction

The interview revealed that students' difficulties in constructing Subject–Predicate–Object (SPO) sentences were persistent throughout the learning process. Although most students possessed adequate vocabulary, they frequently experienced confusion when arranging

sentence elements into the correct grammatical order. According to the participant: *"Students often confuse the predicate with the object, and sometimes they even omit one of these sentence elements. They actually know the words, but they are unsure where each word should be placed within the sentence."* (T1, Grade II Classroom Teacher, Interview, February 2026; translated by the authors).

Limitations of Existing Learning Media

The interview further revealed that Indonesian language instruction relied primarily on textbooks as the main learning resource. The participant explained that textbook-based learning often failed to sustain students' attention because it provided limited opportunities for movement, hands-on interaction, and game-based activities. The participant stated: *"When learning relies only on textbooks, students quickly become bored. They enjoy activities that involve movement, games, and objects they can touch and manipulate."* (T1, Grade II Classroom Teacher, Interview, February 2026; translated by the authors).

Desired Characteristics of Learning Media

Regarding the characteristics of effective learning media, the participant emphasized that instructional media should accommodate differences in students' learning readiness by providing tasks with varying levels of difficulty. The participant also highlighted the importance of presenting a clear visual representation of the Subject–Predicate–Object (SPO) structure and incorporating concrete, hands-on learning experiences. The participant explained: *"I need learning media that can provide different levels of task difficulty because students in my classroom have different learning abilities. However, with the current textbooks, every student is expected to complete exactly the same exercises."* (T1, Grade II Classroom Teacher, Interview, February 2026; translated by the authors).

Contextual and Motivational Factors

The participant also explained that students were more motivated when learning activities reflected their daily experiences and were presented in the form of games rather than conventional written exercises. According to the participant, presenting learning tasks as playful activities encouraged students to participate more actively and confidently during lessons. The participant stated: *"When practice activities are presented as games, students do not feel as though they are being tested. They become more willing to participate, try solving the tasks, and are no longer afraid of making mistakes."*

3.1.3 Documentation Findings

Review of teacher lesson plans, daily teaching notes, and student written work samples provided independent corroboration of the patterns identified through observation and interview. The documentation findings, organized according to the three review sheet indicators, are presented in Table 4.

Table 4. Documentation Review Findings

Indicator	Documentation Findings
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(1) Teacher's lesson plans and daily teaching notes	Review of the teacher's daily teaching notes confirmed that Indonesian language lessons on SPO material were consistently planned using a lecture-and-copy format, with no manipulative activity, visual structural aid, or differentiated task provision recorded across the observed instructional period
(2) Samples of students' written work on SPO sentence construction	Analysis of student written work samples revealed four recurring error types across the majority of students: (a) positional transposition, in which predicate and object elements were placed in reversed order; (b) object omission, in which the sentence was terminated at the predicate without completing the SPO structure; (c) predicate omission, in which only the subject and object were written without a connecting predicate; and (d) single-word response, in which the student produced only one word without attempting sentence construction.
(3) Classroom learning documentation and activity records	Classroom activity records confirmed the complete absence of any manipulative media, game-based activity, or differentiated task delivery during the documented instructional period; all recorded activities consisted of uniform textbook exercises completed individually under teacher verbal direction

3.1.4 Synthesis of Identified Learning Needs and ROLL-PAJA Media Design

The triangulation of observational data, teacher interview findings, and student written work documentation reveals a consistent and multi-dimensional pattern of learning needs that together constitute the empirical basis for the design specifications of an instructional medium. Across all three data sources, five distinct but interrelated needs were confirmed: the need for concrete and physically manipulable learning media; the need for a structured visual scaffold for SPO positional logic; the need for kinesthetic and game-based engagement mechanisms; the need for contextually grounded learning materials relevant to students' coastal environment; and the need for a differentiated exercise system responsive to varying student readiness levels. The correspondence between documented learning problems, identified needs, and the media components required to address them is summarized in Table 5.

Table 5. Correspondence Between Learning Problems, Identified Needs, and Required Media Components

Aspect	Findings	Identified Needs	Media Component Needed
Learning Method	Teachers predominantly used lecture methods, and students only copied examples without physical activities.	Learning should shift from passive participation to active engagement.	[Rolling Ball] A kinetic, game-based mechanism for determining turns or learning challenges that encourages physical participation.
Sentence Structure Visualization	Students had difficulty distinguishing Subject, Predicate, and Object positions because explanations were delivered verbally.	A clear visual representation of sentence structure is required.	[SPO Board] A structured visual-spatial board with designated slots for arranging word cards according to the SPO pattern, including movable word cards for direct manipulation.
Learning Media Availability	Learning relied heavily on textbooks, and no manipulative teaching aids were available.	Students need concrete and hands-on learning media.	[SPO Board + Word Cards] A set of physically manipulable components, including movable word cards, that provide direct manipulation experiences integrated within the SPO Board.

Aspect	Findings	Identified Needs	Media Component Needed
Student Engagement	Students appeared bored, frequently looked outside the classroom, and lost concentration during sentence-construction activities.	Learning media should contain game-based elements to maintain attention and motivation.	[Rolling Ball] A game-based mechanism that creates a playful learning atmosphere and increases student participation through kinetic turn-taking.
Physical Interactivity	Students preferred activities involving movement and direct participation.	Media should involve kinesthetic learning experiences.	[Rolling Ball] A kinetic component that combines physical movement with learning activities through a rolling mechanism that physically determines each student's turn.
Contextual Learning	Learning resources were not closely connected to students' daily experiences in the coastal environment.	Learning media should use familiar elements from children's daily lives.	[Fictional Snacks] A contextually themed packaging element shaped as fictional coastal snack containers, drawn from students' daily environment, to make learning materials feel familiar and attractive.
Differentiated Learning	Students demonstrated different levels of cognitive readiness and learning speed.	Media should facilitate differentiated instruction.	[Color System + Fictional Snacks] A tiered exercise system that categorizes tasks into easy (Yellow), medium (Green), and difficult (Red) levels, delivered inside Fictional Snacks containers.
Psychological Comfort	Students often perceived exercises as formal academic tasks that reduced enthusiasm.	Learning activities should reduce anxiety and increase enjoyment.	[Fictional Snacks] A non-test-like task format that presents exercises inside fictional snack packaging in a playful rather than test-oriented manner, reducing academic anxiety.
Challenge Management	Teachers required an efficient way to organize different difficulty levels without labeling students.	A practical differentiation system is needed.	[Color System] A color-coded differentiation system (Yellow = easy, Green = medium, Red = difficult) that allows teachers to assign appropriate challenge levels without publicly labeling student ability.
Classroom Practicality	Teachers needed media that could be moved easily and used in various classroom situations.	Media should be portable, durable, and flexible.	[All Components] A lightweight, movable, and classroom-friendly integrated design suitable for individual and group activities.

Based on the triangulated findings presented in Table 3, the researcher designed the ROLL-PAJA learning media (Rolling Ball, SPO Board, and Fictional Snacks) as a manipulative instructional medium to address students' difficulties in constructing Subject–Predicate–Object (SPO) sentences. The term “Fictional Snacks” refers to fictional snack-shaped packaging containers — not actual food — used as a gamification element to hold tiered exercise cards in an engaging and playful format. The theoretical rationale for each design decision and the technical description of each component are presented in the Discussion section (3.2). The conceptual model connecting learning problems, identified needs, ROLL-

PAJA components, and expected outcomes is presented in Figure 1, while the physical design of the media is presented in Figure 2.

3.2 Discussion

The results of this needs analysis reveal five interconnected layers of problems that systematically explain the persistent SPO learning difficulties at SDN 3 Sedayulawas Grade II and that together define the design requirements for an effective instructional medium. Each layer follows a data-first interpretive structure: the specific empirical finding from the results section is stated first, followed by the theoretical framework that explains it, and concluded with the design implication for ROLL-PAJA. This sequencing ensures that theoretical claims are grounded in field evidence rather than applied deductively, and that the design specifications derived are traceable to concrete classroom observations and interview data.

The first layer of interpretation concerns the developmental mismatch between instructional modality and learner cognitive stage. The central field finding is that all ten students demonstrated adequate oral vocabulary yet consistently failed to organize those same words into correct written SPO sequences — confirmed across both observation sessions and student written work samples. This dissociation is directly interpretable through Piaget’s concrete operational framework: because Grade II students remain dependent on physical manipulation to construct logical understanding of abstract structures, verbal-only SPO instruction without any concrete mediating artifact is theoretically insufficient at this developmental stage. Hayat et al. (2024) affirm that children aged 7–11 are developmentally dependent on direct physical manipulation of objects to construct logical understanding of abstract structural concepts. Concrete and physically manipulable media for SPO learning are therefore expected to resolve this developmental mismatch by providing the enactive structural experience that symbolic instruction alone cannot offer.

The second layer concerns the scaffolding gap at the level of individual student performance. The observation finding that the teacher’s sole corrective strategy across both sessions was verbal re-explanation — which demonstrably failed to improve student outputs within the same session — points to a structural absence of mediating scaffolding artifacts. Applied through Vygotsky’s ZPD framework, this finding indicates that the gap between students’ independent performance and target SPO competency is currently being bridged only by verbal instruction, which observation data confirmed to be insufficient. Lei and Bakar (2025) affirm that meaningful learning requires a structured mediating artifact to bridge this gap. A physical mediating artifact with graduated structural cues for SPO arrangement is therefore expected to externalize the scaffolding function that verbal re-explanation alone has failed to provide in this classroom.

The third layer concerns the representational sequencing of SPO instruction. The documentation of student written work samples revealed four recurring error types — positional transposition, object omission, predicate omission, and single-word responses — all of which represent failures at the symbolic production stage. Critically, observation data confirmed that students were required to produce these symbolic written outputs without having first passed through any enactive or iconic learning stage: no physical manipulation of sentence elements occurred, and no visual representation of SPO structure was ever

displayed. Arsyad et al. (2024) prescribe, based on Bruner's enactive-iconic-symbolic framework, that this sequence — from physical action through visual representation to abstract symbol — is the required order for durable conceptual understanding. The observation finding that students were required to produce symbolic written SPO outputs without first passing through enactive or iconic stages represents a direct inversion of this sequence, and directly explains the error patterns documented in student written work. A medium that restores this enactive-to-symbolic progression is expected to produce more durable structural understanding than the current approach.

The fourth layer concerns the cognitive architecture of current SPO instruction. Both observation sessions confirmed that the teacher's delivery relied exclusively on the verbal channel: oral explanation of sentence patterns supplemented only by writing sentence examples on the board, which students then copied. The visual-spatial channel — through which positional, color-coded, or structural cues would be processed — was entirely unengaged throughout both sessions. This single-channel instructional architecture directly predicts the pattern of positional errors documented in student written work. Mayer (2024) demonstrates that single-channel instruction systematically increases extraneous cognitive load and fails to achieve the dual-channel integration necessary for meaningful structural learning. The verbal-only instruction documented in both observation sessions of this study is therefore a direct structural explanation for the positional transposition and omission errors found in student written work. A medium that activates the visual-spatial channel concurrently — through color-coded SPO slots and movable word cards — addresses precisely this cognitive gap.

The fifth layer concerns the absence of differentiated instructional support. The teacher interview finding constitutes the primary empirical basis for this layer: the participant explicitly identified that students in her classroom demonstrate meaningfully different levels of cognitive readiness for SPO construction, yet the documentation review confirmed that all recorded instructional activities consisted of uniform textbook exercises completed individually under the same conditions, with no differentiation in task complexity, format, or support. This direct mismatch between observed learner variability and uniform instructional provision is interpretable through Tomlinson's Differentiated Instruction framework. Gibbs (2025), extending Tomlinson's framework, confirms that uniform instruction systematically fails students across the readiness spectrum. The teacher interview finding in this study — that students demonstrate meaningfully different cognitive readiness levels yet receive identical textbook exercises — is a direct field confirmation of this gap. A tiered, color-coded exercise system delivered within ROLL-PAJA is designed to resolve this mismatch by enabling differentiated task assignment without publicly labeling student ability.

Finally, the gamification dimension of ROLL-PAJA is further supported by Barz et al. (2024), whose meta-analysis of digital game-based learning interventions in school contexts demonstrated that DGBL consistently produces significant positive effects on affective-motivational outcomes — including intrinsic motivation, engagement, and enjoyment — particularly when game mechanics are coherently integrated with instructional objectives. This theoretical support aligns with the field finding that students' engagement levels are substantially higher during learning activities involving physical movement and game

elements compared to textbook-based instruction, as consistently reported by the teacher and corroborated through behavioral observation.

Taken together, the five theoretical layers converge on a unified design rationale: an effective instructional medium for SPO learning at the lower-grade elementary level must simultaneously provide concrete physical manipulation, visual-spatial structural scaffolding, an enactive-to-symbolic representational sequence, dual-channel cognitive engagement, and a tiered differentiation system. These five requirements, derived empirically from field data and grounded theoretically in the frameworks established in the introduction, constitute the design specifications that the ROLL-PAJA media is intended to operationalize. It must be emphasized that the present study is a needs analysis and not an effectiveness trial. All claims presented in this discussion are framed as theoretically grounded design rationales and expected potential outcomes pending empirical verification through subsequent development, expert validation, and experimental research phases. The operationalization of these five design specifications into the ROLL-PAJA media components is presented below.

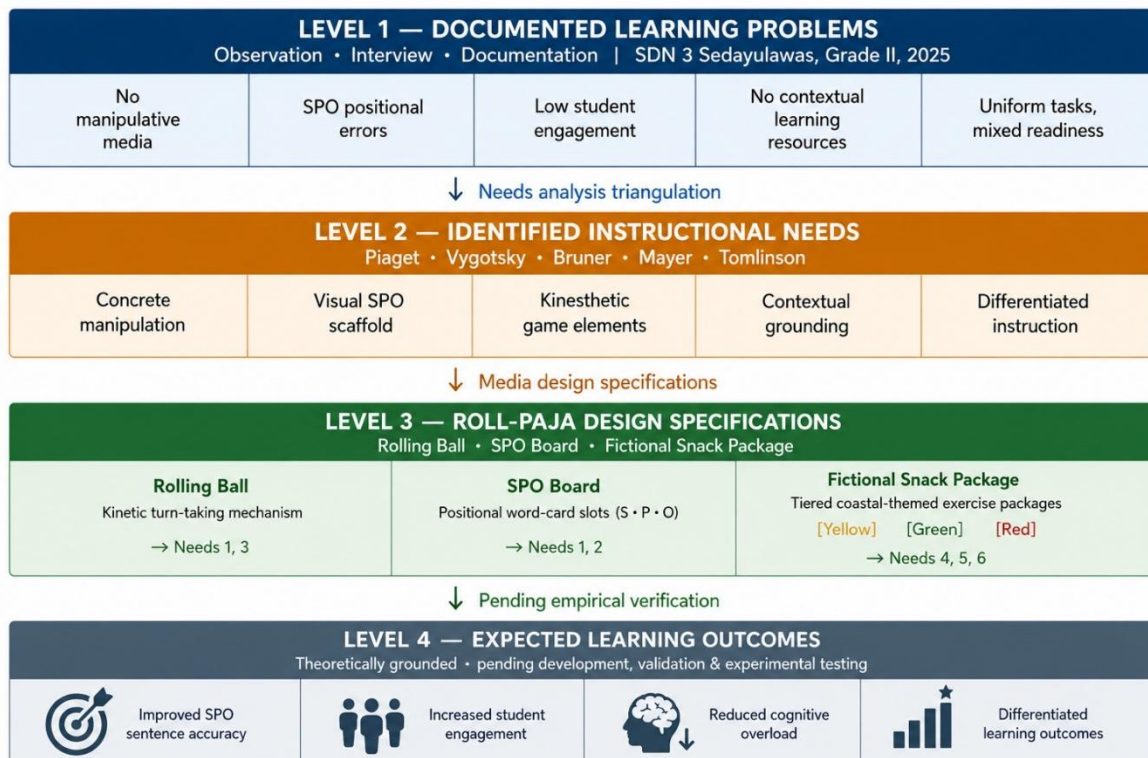


Figure 1. Conceptual Model of ROLL-PAJA Media: From Learning Problems to Expected Outcomes

The physical design of the ROLL-PAJA media is presented in Figure 2. The front view illustrates the arrangement of the Rolling Ball pathway, SPO Board, and fictional snack compartments. In contrast, the rear view presents the supporting structure and storage arrangement that facilitate portability and classroom implementation. The Rolling Ball component functions as a kinetic learning element that encourages students' active participation through game-based activities. The SPO Board serves as a structural-visual aid that helps students organize words into appropriate Subject, Predicate, and Object positions through clearly defined slots. Fictional snacks function as a contextual and motivational

component in which tiered exercise cards (yellow for easy, green for medium, red for difficult) are packaged in fictional snack containers, enabling differentiated learning within a psychologically safe and playful format. The operational procedure of ROLL-PAJA is designed to be straightforward and executable within a standard learning session of approximately 35–40 minutes with a full class of up to 30 students. In the preparation phase (5 minutes), the teacher places the SPO Board on a flat surface, positions the Rolling Ball track alongside it, and distributes the Fictional Snacks containers to designated table groups, each pre-filled with color-coded exercise cards matched to the readiness level of the students at that group. In the main activity phase (25–30 minutes), students take turns rolling the ball; the student whose position the ball reaches selects a word card from the SPO Board and places it in the correct Subject, Predicate, or Object slot, guided by the color-coded labels. After each placement, the group discusses whether the sentence element is correctly positioned before the next student takes a turn. When a complete SPO sentence is formed on the board, all students in the group copy the sentence onto their individual worksheets and retrieve one exercise card from their Fictional Snacks container to independently complete a differentiated written task. In the closing phase (5 minutes), the teacher facilitates a brief whole-class review of selected sentences from the board, inviting students to identify any positional errors and reconstruct the correct SPO sequence collaboratively.



Figure 2. Design and Components of ROLL-PAJA Learning Media

Taken together, the conceptual model and physical design presented in Figure 2 illustrate how the design rationale developed in this study is operationalized into a concrete instructional medium. It is important to reiterate that this study was conducted as a needs analysis aimed at identifying and theoretically grounding the design requirements for SPO learning media at SDN 3 Sedayulawas Grade II, and not as a trial of the medium's instructional effectiveness. The resulting ROLL-PAJA design therefore represents a theoretically and empirically informed design proposal whose actual impact on student learning outcomes remains to be established through subsequent expert validation and experimental research.

4. CONCLUSION

This study identified the specific media needs for developing ROLL-PAJA to support SPO sentence writing in Grade II at SDN 3 Sedayulawas. Triangulated findings from observation, interview, and documentation consistently revealed a gap between students' adequate oral vocabulary and their inability to produce correct written SPO structures — a gap compounded by teacher-centered instruction, exclusive reliance on textbooks, and the absence of any concrete or visual learning aid. The school's coastal socioeconomic context further underscored the need for contextually grounded media that bridges students' everyday language experience with formal written sentence construction. The identified strategic needs encompass three interrelated dimensions: (1) kinetic interactivity so that students are physically engaged in learning and not merely passive observers; (2) contextual elements familiar to children's world to enhance motivation and reduce learning anxiety; and (3) a system supporting differentiated learning to accommodate differences in students' cognitive speed without creating ability stigma.

The resulting ROLL-PAJA design integrates four functionally interrelated components: Rolling Ball as a kinetic turn-taking mechanism; the SPO Board as a visual-spatial structural scaffold; Fictional Snacks as a playful, non-test-like exercise format; and a Color System (Yellow, Green, Red) enabling differentiated task assignment without ability stigma. Together, these components operationalize the Merdeka Curriculum's vision of active, enjoyable, and student-centered learning. As noted in the Methods section, the scope of this study was bounded by design to a single Grade II classroom at one coastal elementary school; the findings therefore reflect the specific contextual conditions of SDN 3 Sedayulawas and may not be directly generalizable to other educational settings. Further research in the form of ROLL-PAJA media testing and effectiveness evaluation on students' learning processes and outcomes is strongly recommended as the next stage of this development.

5. AUTHORS' NOTE

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