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Estimating Classroom Activeness in Science Learning: Proportions, Benchmarks, and Implications in an Indonesian Junior High

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Abstract
This study addresses the need for classroom-level evidence on student activeness in junior-high science by estimating the proportion of learners across engagement categories during routine lessons. Using a quantitative, descriptive, cross-sectional design, data were collected in a single administration from an intact eighth-grade class at SMPN 14 Bengkulu City (N = 30; 15 male, 15 female; response rate 100%). A 15-item Likert-type questionnaire operationalized five indicators of classroom activeness (participation in discussions, articulating opinions, initiating questions, problem solving, and involvement in practical work). Responses were summarized as frequencies and percentages across five categories (Inactive, Less active, Moderately active, Active, Very active). Results showed no students in the Inactive or Less active categories (0% each), with 10% Moderately active, 30% Active, and 60% Very active, indicating a strongly favorable engagement profile in day-to-day science instruction. These findings suggest that classroom routines in the observed setting support frequent student voice, questioning, and hands-on involvement, and they provide a category-based benchmark that makes heterogeneity visible for instructional decision-making. The principal contribution is a practical baseline reported as proportions rather than only mean scores that schools can use to set targets, tailor supports for moderately active students, and monitor shifts over time. Implications include guiding teacher professional development toward participation-eliciting routines, informing resource allocation for practical activities, and establishing a measurement approach that can be scaled and triangulated (e.g., with classroom observations) to drive continuous improvement in lower-secondary science learning.

Keywords: Benchmarking; Classroom engagement; Junior high school; Science education; Student activeness.

INTRODUCTION

Student activeness encompassing cognitive effort, behavioral participation, and affective involvement during learning activities has been widely recognized as a central driver of meaningful science learning in lower-secondary classrooms. When students routinely ask questions, articulate ideas, and engage with hands-on tasks, they are more likely to construct robust conceptual understandings and sustain effort on challenging content, because such engagement prompts them to connect prior knowledge with new evidence, monitor and adjust their thinking in real time, and benefit from immediate feedback from peers and teachers. In practical terms, active learners participate in purposeful discussions, justify claims with data, design or refine procedures during practical work, and reflect on mistakes as opportunities to improve, behaviors that collectively deepen comprehension and normalize productive struggle when topics are abstract or counterintuitive. As a result, classrooms that deliberately structure opportunities for questioning, explanation, and experimentation tend to foster a stronger sense of ownership, relevance, and persistence, enabling adolescents to maintain attention, persevere through difficulty, and consolidate understanding over time without altering the core goals of the lesson (Ben-Eliyahu et al., 2018; Cents-Boonstra et al., 2021; Theobald et al., 2020). Contemporary engagement frameworks in science education therefore highlight that learning is optimized when learners are positioned as active agents rather than passive recipients, with activeness functioning as a proximal indicator of the quality of classroom interactions. In practice, positioning students as agents means they initiate questions, negotiate meanings with peers, and make evidence-based claims during inquiry and discussion, while teachers scaffold rather than dominate the talk. Under these conditions, observable markers of activeness such as the frequency and depth of student contributions, responsiveness to feedback, and persistence during hands-on tasks serve as near-real-time signals that classroom discourse is cognitively demanding, dialogic, and supportive. Consequently, tracking activeness offers a practical window into whether instructional routines are eliciting productive thinking and collaboration, making it a sensitive barometer for the overall health of the learning environment (Ben-Eliyahu et al., 2018; Cents-Boonstra et al., 2021; Patall et al., 2018).

A large body of research further shows that active learning approaches such as problem solving, structured discussion, and inquiry-based practical work consistently outperform lecture-dominant routines, improving average outcomes while narrowing achievement gaps. By expanding opportunities for sense-making, retrieval, and timely feedback, these designs foster deeper conceptual understanding, stronger long-term retention, and more robust transfer to novel contexts. The collaborative structures they employ also distribute participation more equitably, elevating performance among students who have been historically underserved without diminishing gains for higher achievers. Mechanistically, frequent low-stakes checks for understanding, student-generated explanations, and hands-on investigation increase cognitive activation and time on task while strengthening metacognitive monitoring and persistence. Consequently, evidence-informed science teaching positions active learning as the default architecture of a lesson, with concise, targeted exposition used strategically to consolidate ideas rather than to dominate instructional time (Freeman et al., 2014; Strelan et al., 2020; Suryawati et al., 2020). Mechanistically, such designs support deeper processing, better regulation of attention, and more favorable achievement-related emotions, thereby sustaining motivation over time (Noetel et al., 2021; Patall et al., 2018; Yustina et al., 2020).Within this ecology, students' learning interest and participation are shaped by teacher practices (e.g., autonomy support and instructional clarity), the affordances of instructional media, and the broader classroom climate; these factors jointly raise students' willingness to contribute, persist, and collaborate during science lessons (Noetel et al., 2021; Patall et al., 2018; Tao et al., 2022). Consequently, documenting class-level activeness is pedagogically useful because it translates complex interactions into actionable information for teachers and school leaders (Cents-Boonstra et al., 2021; Theobald et al., 2020)

Interest theory complements this perspective by explaining that situational interest is triggered by instructional features that are enjoyable, attention-demanding, and conducive to exploration features that are most potent when learners are prompted to participate rather than merely observe. In practice, novelty, optimal challenge, and meaningful choice heighten the perceived value of a task, while hands-on inquiry, collaborative problem solving, and multimodal representations focus attention and invite active exploration. These conditions strengthen affect (enjoyment), sharpen cognitive engagement (sustained attention and sense-making), and elicit behavioral investment (persistence and willingness to contribute), creating a self-reinforcing cycle in which participation deepens curiosity and curiosity, in turn, sustains participation. Consequently, lessons that foreground action feedback reflection loops and provide room for student agency are more likely to kindle and maintain situational interest than those that rely on prolonged, passive exposure to content (Hidi & Renninger, 2019; Mallari & Tayag, 2022; Pasco & Roure, 2022). In science classrooms, such features can be fostered through well-designed prompts, collaborative structures, and media that concretize abstract ideas; in turn, these conditions are associated with improved attitudes toward science and stronger intentions to persist (Alhadabi & Karpinski, 2020; Blotnicky et al., 2018; Noetel et al., 2022). Taken together, the theoretical and empirical literatures converge on the view that monitoring and cultivating activeness is not a peripheral concern but a core element of effective science teaching (Ben-Eliyahu et al., 2018; Cents-Boonstra et al., 2021; Theobald et al., 2020).

In the Indonesian context, emerging evidence indicates that context-aware pedagogies such as blended or project-based learning, interactive worksheets, and locally grounded tasks can elevate students' participation and strengthen their interest in science. Nevertheless, the bulk of these reports presents outcomes as post-intervention gains or class mean scores, offering limited visibility into classroom dynamics at baseline; far fewer studies provide descriptive profiles that show how students are distributed across activeness categories (e.g., inactive, moderately active, active, very active) during ordinary, non-intervention lessons. As a result, it remains difficult to benchmark typical participation patterns, to compare classes or schools on a like-for-like basis, and to target pedagogical supports where they are most needed all of which would benefit from routine reporting of categorical activeness distributions in everyday science instruction (Ahmad et al., 2021; Setiati & Jumadi, 2022; Yustina et al., 2020). Moreover, while international syntheses offer strong rationales for active learning, school-based diagnostics that estimate the proportions of inactive, moderately active, active, and very active students within a typical class remain comparatively scarce, limiting their immediate utility for classroom-level planning and monitoring (Ma & Wei, 2022; Noetel et al., 2021; Theobald et al., 2020). Methodologically, brief Likert-type questionnaires can capture multi-indicator participation efficiently covering behaviors such as speaking during discussions, initiating questions, and engaging in practical work provided that instrument content is aligned and reliability is adequate, and that results are summarized transparently for decision-making (Ben-Eliyahu et al., 2018; Räisänen et al., 2022; Suryawati et al., 2020).

Despite converging evidence on the value of active participation, few descriptive, class-level studies in Indonesian junior-high settings report the proportions of students across activeness categories during routine science lessons; most available reports prioritize intervention effects or examine older cohorts. This evidentiary gap constrains schools' capacity to establish like-for-like benchmarks, monitor typical participation patterns, and allocate pedagogical supports strategically where they are most needed**.** (Kaur et al., 2022; Setiati & Jumadi, 2022; Strelan et al., 2020). Addressing this gap, the present study provides a classroom-based descriptive profile of eighth-grade students' activeness in science at a state junior-high school in Bengkulu City. Specifically, it estimates the percentage of learners in each activeness category (inactive, less active, moderately active, active, very active) across multiple participation indicators (e.g., asking questions, contributing to discussion, responding to problems, engaging in practical work), thereby offering a transparent snapshot of routine lessons. The resulting profile functions as a practical baseline for like-for-like benchmarking within and across classes, for instructional planning and targeted support, and for evaluating subsequent improvement efforts over time. (Ma & Wei, 2022; Noetel et al., 2022; Theobald et al., 2020).

METHOD

This study used a quantitative descriptive design to characterize students' classroom activeness during science lessons and was conducted on 28 October 2019 in an eighth-grade class at SMPN 14 Bengkulu City (Padang Nangka, Singaran Pati, Bengkulu; postal code 38225). The target population comprised grade-VIII learners; employing total sampling, all 30 students in the focal class participated (15 male, 15 female; response rate 100%). Data were collected with a paper-and-pencil questionnaire designed to capture multi-indicator participation during routine science activities. The instrument contained 15 items mapped to five commonly used indicators of activeness contributing to discussion, articulating opinions, responding to/solving problems, initiating questions, and participating in practical work each rated on a five-option Likert scale (never, rarely, sometimes, often, always). Administration occurred during the scheduled science period under normal classroom conditions; students completed the questionnaire individually and anonymously, and no personally identifying information was gathered. For classroom-level interpretability, responses were summarized into five categories (inactive, less active, moderately active, active, very active) according to the rubric used in the original report, and results were expressed as frequencies and percentages. The proportion for each category was computed using Equation (1); the category labels and the summary distribution are retained in Table 1 to maintain transparency and comparability with the original presentation. Administrative permission was obtained from school leadership prior to data collection.

$$P = \frac{f}{N} \times 100\%$$

Where:
P : The percentage for a given category
f : The frequency (number of students) in that category
N : the total number of respondents.

RESULTS AND DISCUSSION

Thirty students completed the questionnaire (response rate 100%). The distribution of learning activeness shows a strongly favorable engagement profile: no students were classified as Inactive or Less active, 10% were Moderately active, 30% Active, and 60% Very active. In other words, nine out of ten learners reported frequent to very frequent participation during science lessons, suggesting that classroom routines and teacher prompts in this setting are already conducive to active learning behaviors (e.g., contributing in discussions, asking questions, problem solving, and engaging in practical work).

Table 1. Distribution of Students by Learning Activeness Category (N = 30)

Category	n	%
Inactive	0	0
Less active	0	0
Moderately active	3	10
Active	9	30
Very active	18	60

Interpreted against the wider literature, the predominance of Active/Very active categories aligns with cumulative evidence that participatory designs are associated with deeper processing, persistence on challenging tasks, and more equitable outcomes in science and STEM classrooms (Deslauriers et al., 2019; Mutakinati et al., 2018; van Alten et al., 2019). Specifically, when learners routinely articulate ideas, collaborate, and manipulate materials, they tend to form stronger mental models and regulate attention more effectively mechanisms that help explain the high self-reported activeness observed here (Bisra et al., 2018; Cromley et al., 2020; Skulmowski & Rey, 2018). The pattern is also consistent with studies showing that motivating teaching behaviors (e.g., autonomy support, clear structure, responsive feedback) co-vary positively with student engagement, especially in settings that provide regular opportunities for voice and participation (Burns et al., 2021; Cheon et al., 2020; Rapi et al., 2022). In addition, research on interest development indicates that situational interest is fostered when activities are enjoyable, attention-demanding, and afford exploration; the high proportion of active respondents suggests that such features are present in day-to-day lessons in this cohort (Pasco & Roure, 2022; Roure et al., 2019; Wassalwa et al., 2022). From a contextual perspective, Indonesian studies that integrate blended, project-based, or locally grounded tasks similarly report elevated participation and positive attitudes toward science, reinforcing the plausibility of the current distribution (Hujjatusnaini et al., 2022; Sumarni & Kadarwati, 2020; Utami & Amaliyah, 2022).

Notably, while many empirical reports present mean scores or post-intervention gains, the present study emphasizes category-level proportions (Inactive → Very active) for an intact junior-high class during routine instruction. This framing has practical value: teachers and school leaders can readily translate proportions into actionable targets (e.g., increasing the share of "Very active" students or providing targeted support for the "Moderately active" group), whereas means can obscure heterogeneity (OECD, 2019; Suryawati et al., 2020; Susnjak et al., 2022). The current profile 0% at the two lowest categories and 90% at the two highest functions as a baseline benchmark for subsequent cycles of planning and monitoring (e.g., after introducing specific pedagogical routines or media, such as interactive worksheets or pop-up books, schools can examine whether the distribution further shifts toward "Very active").

First, the overall high activeness echoes meta-analytic and large-scale evidence that active learning is broadly superior to lecture-dominant instruction in STEM, not only by raising average performance but also by reducing failure rates and narrowing gaps for students who have been historically underserved; in this light, a classroom distribution concentrated in the "active/very active" bands is precisely what one would expect when lessons consistently embed problem solving, discussion, and hands-on inquiry (Deslauriers et al., 2019; Ilma et al., 2022; van Alten et al., 2019). Second, the finding comports with classroom-process research showing that autonomy-supportive challenge providing meaningful choices, clear rationales, and tasks calibrated at an optimal level of difficulty reduces disengagement, increases time on task, and sustains persistence during complex activities, patterns that align with the behaviors captured by our participation indicators (An et al., 2022; Burns et al., 2021; Haw & King, 2022). Third, it is compatible with interest theory work in which enjoyment, attention demand, and exploration intention co-occur with observable participation; our evidence of frequent questioning, contribution to discussion, and engagement in practical work is consistent with situational interest being activated and maintained through instruction that is both appealing and cognitively involving (Hidi & Renninger, 2019; Mallari & Tayag, 2022; Pasco & Roure, 2022). Fourth, the profile fits with studies linking classroom climate to engagement and performance, implying that structural and relational conditions in this setting such as predictable routines, equitable talk, and supportive teacher–student interactions are conducive to sustained participation and productive effort (Cents-Boonstra et al., 2021; Räisänen et al., 2022). Fifth, it resonates with Indonesian STEM-education studies reporting that well-designed tasks and digital/interactive media heighten participation and motivation, suggesting that the practices present in this class are aligned with locally validated approaches and are therefore plausible levers for maintaining high activeness in routine lessons (Ahmad et al., 2021; Setiati & Jumadi, 2022; Yustina et al., 2020).

The study contributes a classroom-level, category-based baseline of students' activeness in an Indonesian junior-high science context, derived from an intact class during routine instruction rather than from post-intervention cohorts or higher-education samples that dominate the literature. By reporting proportions across five categories, it deliberately surfaces heterogeneity that mean scores typically obscure revealing, for example, the relative sizes of "inactive," "moderately active," "active," and "very active" groups and thus provides information that is diagnostically richer and immediately actionable. This granularity directly supports school-level instructional decision-making by enabling like-for-like benchmarking across classes or terms, targeting supports to specific subgroups, and monitoring shifts over time as initiatives are introduced. In doing so, the baseline offers a transparent reference point for planning, resource allocation, and professional development, while also creating a replicable template for other schools seeking to map participation patterns in everyday science lessons.

Practically, the distribution provides a decision-useful benchmark for school improvement cycles (e.g., Plan–Do–Study–Act): teams can set explicit targets (for instance, ≥70% of students classified as "Very active"), design supports for the "Moderately active" minority (e.g., structured turn-taking protocols, accountable-talk stems, and low-stakes cold-calling), and monitor shifts across units or terms with simple run charts or heat maps. Instrument-level reporting (by indicator such as questioning, discussion contributions, problem-solving responses, and participation in practical work) can guide resource allocation prioritizing, for example, consumables and equipment for hands-on tasks and shape professional development focused on discourse moves that elevate student voice (e.g., wait time, revoicing, probing, and equitable participation routines). The resulting profile also creates a common evidentiary baseline for research that links activeness categories to downstream outcomes such as science interest, achievement, and retention enabling analytic studies (e.g., regression, multilevel, or longitudinal designs) that move beyond description to identify which instructional levers most effectively shift engagement and learning.

The analysis is descriptive and cross-sectional and relies on self-reports from a single intact class, which limits external validity and introduces potential social-desirability and common-method inflation. In addition, the instrument's psychometric properties were not documented (e.g., internal consistency indices such as Cronbach's α and evidence of dimensionality or factor structure), and no observational triangulation (e.g., classroom observations or teacher logs) was undertaken to corroborate students' reports. Future research should broaden the sampling frame to include multiple classes and schools, incorporate systematic classroom observations and teacher logs, and provide explicit reliability–validity evidence for any measurement instruments. It should also move beyond description by modeling predictors and outcomes of activeness such as specific teaching moves, instructional media use, or classroom climate using appropriate multivariate techniques (e.g., regression/SEM or multilevel models) and, where feasible, longitudinal or pre–post designs to enable explanatory and evaluative inferences.

CONCLUSION

This study provides a classroom-level profile of students' active participation in junior-high science lessons and shows a strongly favorable engagement baseline: in a cohort of 30 eighth-graders, no learners were classified as inactive or less active, 10% were moderately active, 30% were active, and 60% were very active during routine instruction. These proportions indicate that day-to-day pedagogy in the observed setting already supports frequent student voice, questioning, problem solving, and participation in practical work. The chief contribution is a category-based benchmark (rather than only mean scores) that makes heterogeneity visible and can be directly used for school improvement e.g., setting targets to lift the share of "very active" students, tailoring supports for the "moderately active" group, and monitoring shifts across terms. Practically, the findings inform instructional planning, resource allocation for hands-on activities, and teacher professional development focused on participation-eliciting routines. The study is limited by its single-class, cross-sectional, self-report design and the absence of psychometric and observational triangulation; future research should extend to multi-school samples, report reliability/validity evidence, incorporate classroom observations, and examine how activeness categories relate to downstream outcomes such as science interest, achievement, and retention.

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